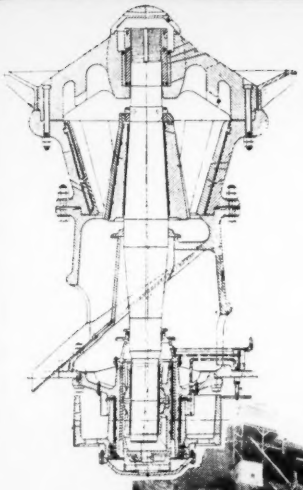
Pit and Quarry

SAND ▪ GRAVEL ▪ STONE

HANDLING ▪ CRUSHING ▪ SCREENING ▪ WASHING

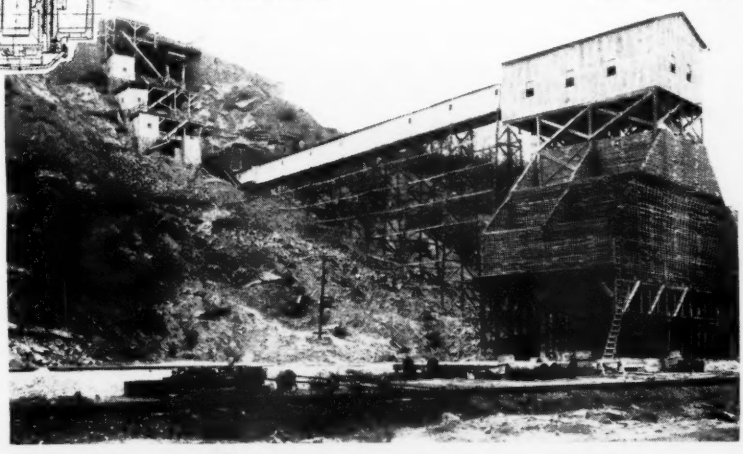


KENNEDY EQUIPMENT IS IMPORTANT IN ZENITH EFFICIENCY

The Zenith Limestone Company plant at Tulsa, Oklahoma, is a modern 2,000 ton plant. It is equipped throughout with Kennedy Gearless Crushers and Kennedy Screens.

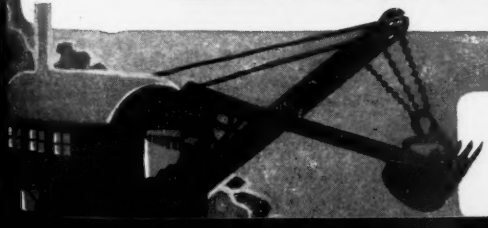
There is a reason why Kennedy Equipment is specified for so many plants. Kennedy Catalogue outlines these reasons—reasons proven in practice. Write for your copy.

KENNEDY VAN SAUN MFG. & ENGR. CORP.
50 Church St. New York City



Standard Ball Bearing Gearless Crusher. Sizes No. 1 to No. 60 — Wt. from 9,000 to 100,000 lbs.

Also fine crushers. One customer reports getting 60 tons per hour ¾" and finer with one machine.



May 15, 1925

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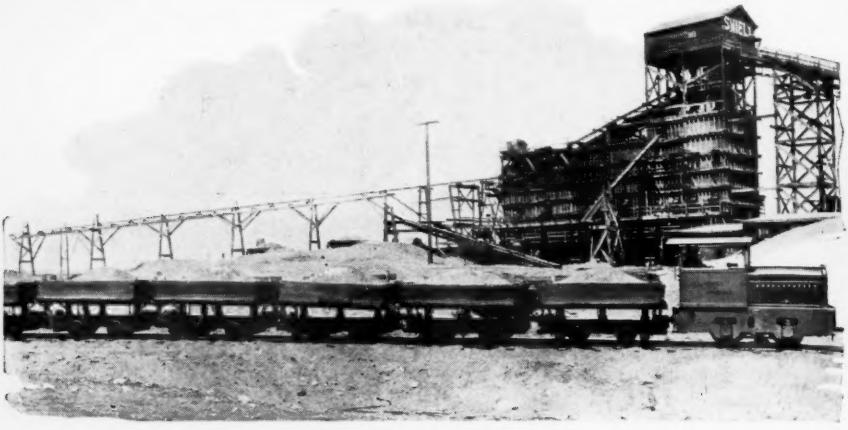


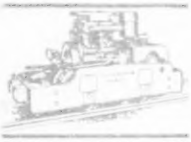
Where dependability counts!

A Whitcomb Locomotive is the one haulage tool that can be relied upon.

Where one process depends upon another and trouble-free equipment is essential, there you will find a Whitcomb Locomotive.

Since 1906, when we built the first successful gasoline locomotive, we have specialized in the building of locomotives which combined moderate first cost, low maintenance cost, with dependability. They insure trouble-free operation.

Write our nearest branch office for detailed information on the type best suited for your job.



THE FIRST SUCCESSFUL GASOLINE LOCOMOTIVE WAS BUILT IN 1906 IT WAS A "WHITCOMB"

Offices in Principal Cities

THE GEO. D. WHITCOMB COMPANY
Rochelle, Illinois

Representatives:
The General Supply Company of Canada, Ltd.
Machinery Corporation, Apartado 76 B, Mexico City, D. F., Mexico.

GASOLINE-STORAGE BATTERY-ELECTRIC
WHITCOMB
LOCOMOTIVES

The ERIE moves the gravel!

Your locomotive runners and truck drivers keep wide awake when you have an ERIE loading out your sand and gravel.

Quick as a car or truck comes into position, the ERIE's snappy action rapidly fills it up—

"She's handling 1½ yds. of gravel per minute, and could do more," writes M. J. Boland, Johnson City, N. Y., telling of his ERIE shown above.

The ERIE is remarkably speedy—with quick acting direct-connected engines for crowding and swinging. Easy to operate fast, with every digging and dumping motion controlled by only three throttle levers.

"My ¾-yd. Type "B" ERIE is loading out gravel at the rate of 1½ cubic yards per minute, and could do more. With this ERIE we are moving 750 cu. yds. per day without any trouble. The ERIE is more than satisfactory and I like it better every day."— *F. J. Boland, Johnson City, N. Y.*

And the reliability of the ERIE has set the standard among power shovel users. Day in and day out, you can depend on the reliable ERIE to get out the gravel or rock.

Actual records have proved that an ERIE needs only ⅓ as many repairs, and makes a corresponding saving in working time. ERIE owners have reported hundreds of output records as good as the one at the left (some even better).

We will be glad to help you figure what an ERIE will do on your work; write us.

ERIE STEAM SHOVEL CO., Erie, Pa., U. S. A.

Incorporated 1883. Formerly Ball Engine Company.

Builders of ERIE *Shovels, Cranes, Ditchers, Draglines, Trench Hoes, etc.*

Branch Offices: Boston, New York, Philadelphia, Pittsburgh, Atlanta, Chicago

Representatives throughout the U. S. A.

ERIE Revolving Shovels

This Bucyrus Shovel is equipped with a TWIN CITY Engine.

TWIN CITY ENGINES

THE Bucyrus Company have found that Twin City Engines are "Built to do the work" required by their gasoline shovels.

Twin City Engines are manufactured in sizes 35 to 140 horsepower—*for Heavy Duty, Stationary, Portable and Traction Outfits.* Literature and specifications sent on request.

Other Twin City Users
Austin Machinery Co.
Baldwin Locomotive Works
The Harnischfeger Corporation
Northwest Engineering Co.
The Parsons Co.
Pennsylvania Pump and Compressor Co.
Russell Grader Mfg. Co.
Star Drilling Machine Co.
Washington Iron Works
Willamette Iron & Steel Works, etc.

TWIN CITY COMPANY
MINNEAPOLIS, MINN.
Heavy Duty Engine Manufacturers Since 1903

"BUILT TO DO THE WORK"

Exactly! Finger-tip control!

YOU can shift the Koehring levers with your finger tips, exactly that! Just as easy as shifting the levers of your automobile!

How does a crane get easy shifting levers? That's important. If the operator loses the "feel" of the bucket which means so much in precision of operation, easy lever shifting comes at too high a price!

Koehring levers shift easily because the double outside band, self-equalizing clutch has 66% more contact surface than ordinary clutches.

Koehring Finger-tip control is not a mere mechanical device to help the operator shift levers. It is not a mechanical complication interposed between the operator and the "feel" of the bucket! It is a fundamental improvement in the design of the working clutch—and means something to smooth, powerful, speedy operation and trouble-free service life. It is another factor of Koehring Heavy Duty construction.

Crane Capacities

No. 1 10 tons at 12 ft. radius. 3-4 cu. yard clamshell bucket, sand or gravel, at 30 ft. radius. Boom lengths to suit conditions. 4 cylinder, 6x6 in. gasoline engine, 1,000 R. P. M.

No. 2 15 tons at 12 ft. radius. Handles following loads sand or gravel (clamshell buckets): 3-4 cu. yd. at 43 ft. radius; 1 cu. yd. at 37 ft. radius; 1 1-4 cu. yd. at 32 ft. radius. Boom lengths to suit conditions. 4 cyl., 5 3-4x7 in. gasoline engine, 1000 R.P.M.

KOEHRING

Crane

Write for Crane Bulletin No. CR 32

KOEHRING COMPANY

PAVERS, MIXERS—GASOLINE CRANES, DRAGLINES AND SHOVELS

MILWAUKEE, WISCONSIN

Sales Offices and Service Warehouses in principal cities

Foreign Dept., Room 1370, 50 Church St., N. Y.

Canada, Koehring Company of Canada, Ltd., 105 Front St., East, Toronto, Ontario.

Mexico, F. S. Lapum, Cinco de Mayo 21, Mexico, D. F.

A 2749-IV

GREAT engineering principles, like other great truths, may be compressed into a few words.

Proper lubrication is provided wherever good engineering indicates, in every Marion shovel, and is not used for those parts which should not be lubricated.

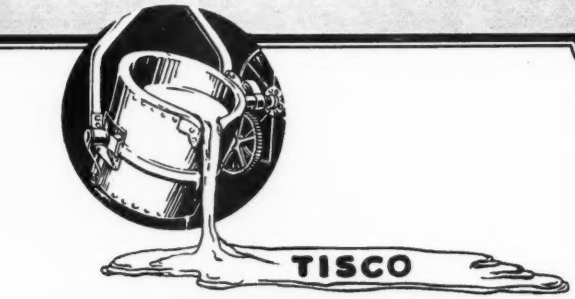
This, the practice of the largest and oldest staff of shovel engineers in the business, is ample assurance to the experienced.

Write for your copy of Marion Lubrication Bulletin illustrating and describing proper lubrication for Marion Shovels.

The Marion Steam Shovel Co., Marion, Ohio, U.S.A.
Established 1884

Come to Shovel Headquarters

MARION



VAN-PORT REVERSIBLE DIPPER TOOTH

(Patented)

The Van-Port reversible dipper tooth has been developed to meet actual demand. Owners and operators of steam shovels know that sharp digging teeth are necessary; they show economy.

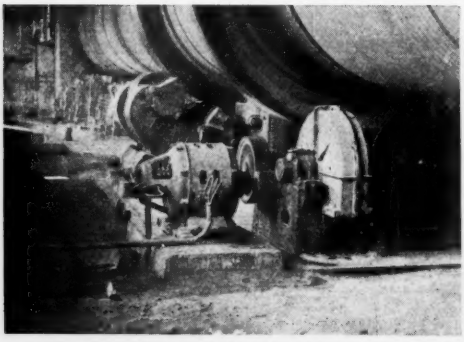
Van-Port dipper teeth are now famous. They are always in efficient working condition because when they begin to get dull they may be reversed —whereupon they re-sharpen themselves. A set of these teeth points may be changed in fifteen minutes as it is not necessary to remove the bases.

Address Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

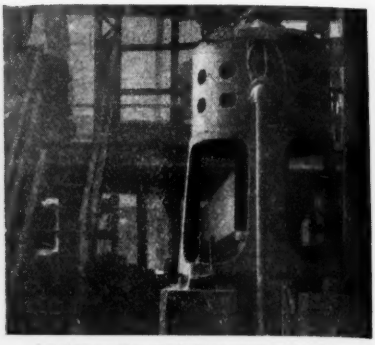
Taylor-Wharton Iron & Steel Co.
HIGH BRIDGE, N. J.

Wm. Wharton, Jr., & Co., Inc.
EASTON, PA.

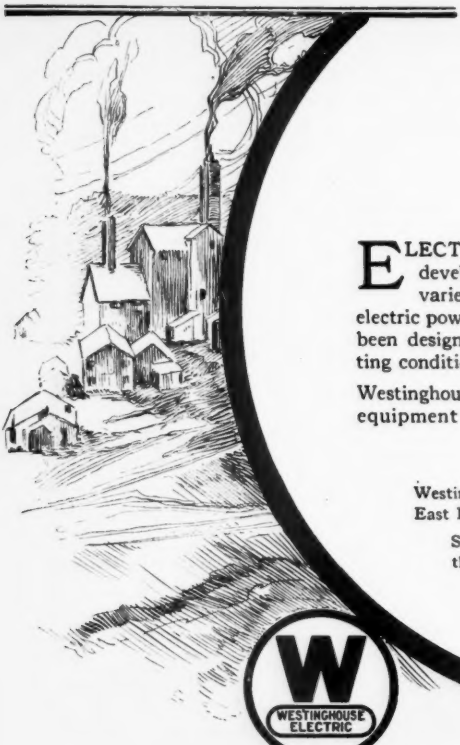
Tioga Steel & Iron Co.
Philadelphia Roll & Mach. Co.
PHILADELPHIA, PA.



CW Motor driving kiln at New Egyptian Portland Cement Co.



One of the two 75 hp. Westinghouse motors driving a 42" Fuller-Lehigh mill at the Security Cement & Lime Co.



Serving A

ELECTRICITY is playing an important part in the development of the rock products industry and its varied branches. To obtain the full benefits of electric power, it is essential to use apparatus that has been designed and manufactured exactly to meet operating conditions.

Westinghouse has for many years been supplying such equipment to leading industries and, through an

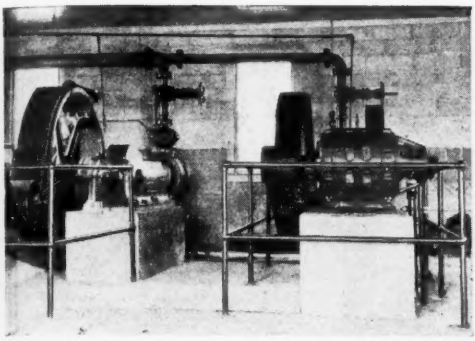
Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania

Sales Offices in All Principal Cities of the United States and Foreign Countries

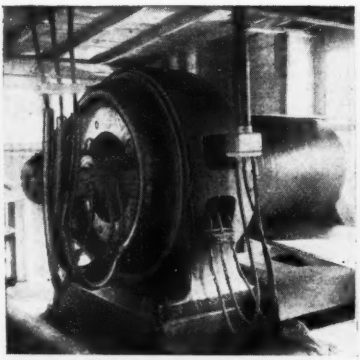
WESTINGHOUSE ELECTRIC

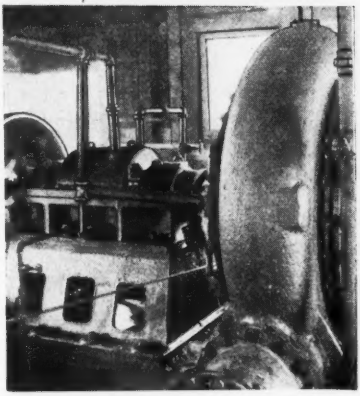
Westinghouse

X 78702-A



A 50 hp. Westinghouse motor driving air compressor at Sand Plant, Cabot, Pa.





400 hp. Westinghouse motor driving a 15 in. centrifugal pump on sand dredge operated by the Morristown County Crushed Stone Company, Morristown, N. J.

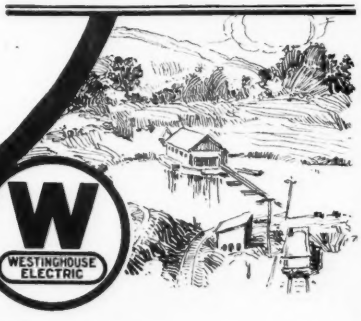
Big Industry

extensive study of the rock products field, is prepared to furnish electrical equipment that will meet all your requirements.

Feel free to consult our engineers about your electric power application problems. You can do so without obligation. Address our nearest District Office.

Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania

Sales Offices in All Principal Cities of
the United States and Foreign Countries



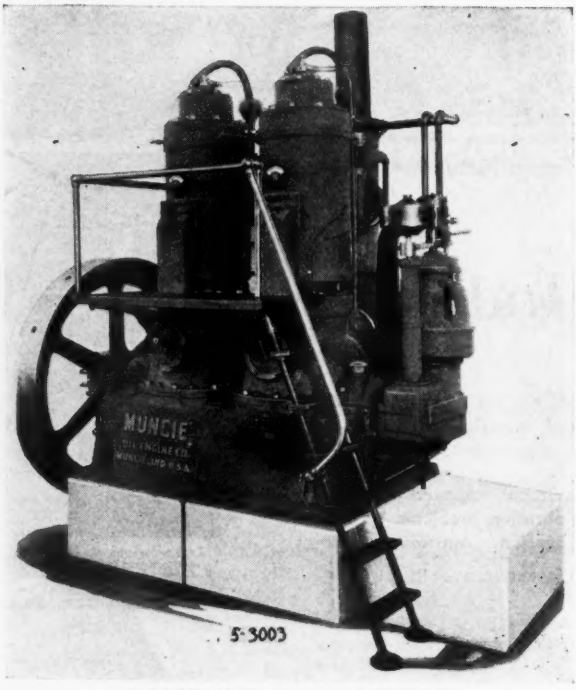
Westinghouse

X 78703-A

TYPE "V" VERTICAL MUNCIE OIL ENGINES

For Crushers, Draglines, Dredges, Pumping, Etc.

Use cheapest fuel oils, and give greatest reliability at lowest all around cost.



2-CYLINDER, 110 H.P., 250 R.P.M.

DRY TYPE COMBUSTION
HIGH COMPRESSION
SOLID INJECTION
COLD STARTING

HEAVILY PROPORTIONED THROUGHOUT.
OPERATIVE CONTROL FROM ONE POINT
SIZES TO SUIT ANY REQUIREMENT FROM 25 to 330 B.H.P.

The Result of over twenty years OIL ENGINE manufacturing experience

WRITE FOR QUOTATIONS TO

MUNCIE OIL ENGINE CO.

724 POWERS AVENUE **MUNCIE, INDIANA**

The practical thing to do—

ask the man who has already "been over the road"

From your own experience, you know how long it takes to get anywhere if you have to try each branch of a cross-roads that isn't marked— to get the right route. It's certainly much quicker— whenever you are able to do it— **to ask the man who has been over the road.**

Picking a bucket is like picking your way over unknown country— if there's any doubt as to which bucket will give you the biggest day's work, just ask the man who "has been over the road."

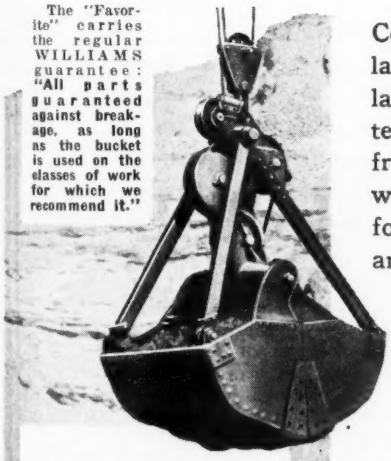
Ask some gravel producers and quarry men who have "tried them all," and you'll get reports like this one from Kirkpatrick Sand & Cement Company of Birmingham, Ala.:—

> **"We have tried many different makes of buckets in the past 15 years, and the WILLIAMS is the best digging bucket we have ever used."**

Just ask Diamond Sand & Gravel Company of Bedford, Ohio, or Cleveland Builders Brick & Supply of Cleveland—any of them who have made tests. They can give you FACTS from their own experience, showing what WILLIAMS Buckets have done for them, in the way of bigger output and lower upkeep cost.

We will be very glad to put you in touch with other producers who have gone into buckets thoroughly, and tested out different makes on a "show me" basis.

We will also be glad to recommend the right bucket for your particular work.



The "Favorite" carries the regular WILLIAMS guarantee: **"All parts guaranteed against breakage, as long as the bucket is used on the classes of work for which we recommend it."**

The gravel-digging bucket that's also the pick for general service.

This fast digging WILLIAMS Bucket gives big output excavating gravel and sand from the pit, and gives very good results on your light excavating (with digging teeth bolted on).

Also rehandles bulk materials such as coal, gravel, crushed stone, etc.

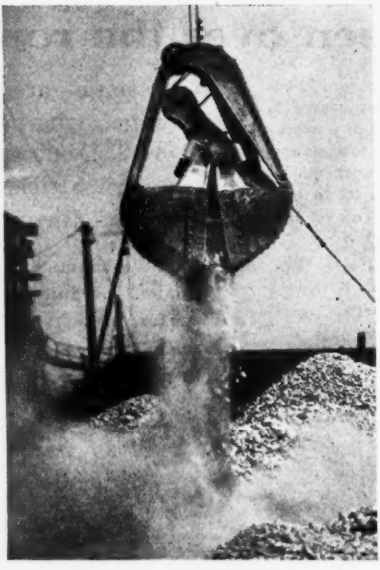
Drop us a line for a complete description.

G. H. WILLIAMS COMPANY,
605 Haybarger Lane, Erie, Pa.
Eastern Office: 30 Church St., New York City

WILLIAMS
FAST-DIGGING BUCKETS
All Parts Guaranteed Against Breakage

MEAD-MORRISON

TYPE "W" GRAB



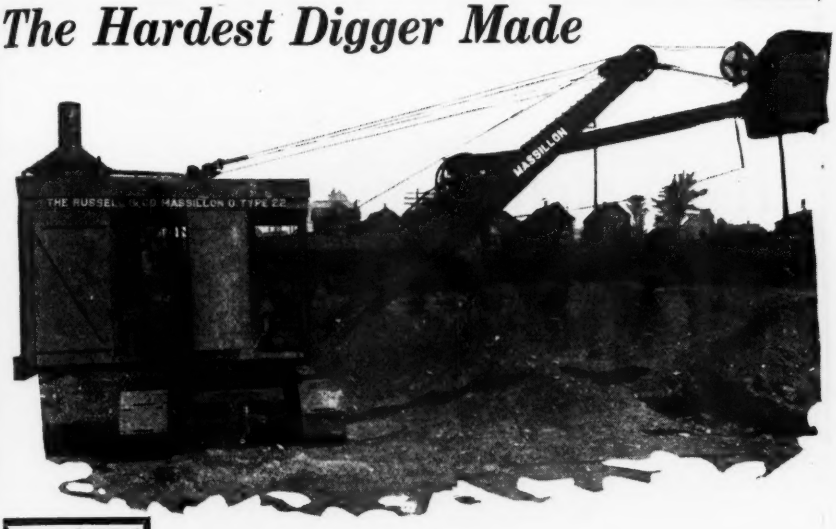
FAST DISCHARGE

NOTICE how the Type "W" Grab drops its load when the shells are barely open. Their deep-curved design gives almost instantaneous discharge with no time lost between trips. All kinds of materials, from fine sand to big rocks are handled easily and economically. Type "W" digs down as it closes, the powerful jaws filling the Bucket for a capacity load every trip. The terrific "bite" combined with the light weight of the Grab, variable rope reeving and attachable weights makes the Bucket **Universal in use** —as efficient on heavy excavating as on fast rehandling. It gives more pounds per load, more loads per day and dependable year-round service.

MEAD-MORRISON
MANUFACTURING COMPANY

528 Prescott Street **East Boston, Mass.**

The Hardest Digger Made



The 3/4--7/8 **Range**

Power-Strength-Speed
The Massillon Steam Shovel

The Massillon Steam Shovel has been built to meet your need for Efficient Shovel Service. It combines those qualities recognized in expert engineering practices as standard. It is equally efficient with clam shell, as part of dragline equipment, and as locomotive crane.

Mobility and Accessibility are qualities which add much to the machine's efficiency. With the Massillon you can handle maximum quantities of of any kind of material.

Shovel illustrated is equipped with One Yard Bucket, 22 ft. 6 in. boom, 17 ft. dipper handle.

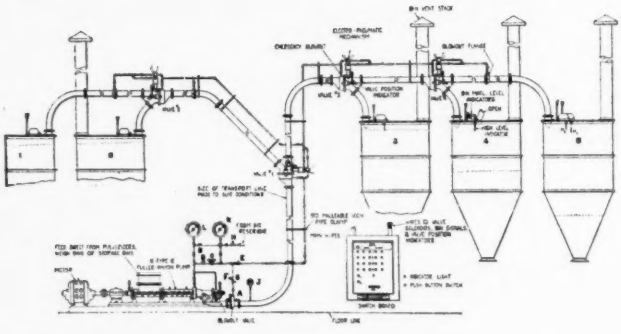
BUILT BY

THE RUSSELL & CO.

MASSILLON, O.

(Established 1842)

SAFETY AND MINIMUM UPKEEP
when using
FULLER-KINYON CONVEYING SYSTEM
for
PULVERIZED MATERIALS



The FULLER-KINYON system facilitates the transportation of pulverized coal, raw material and cement with the ease and convenience of a fluid.

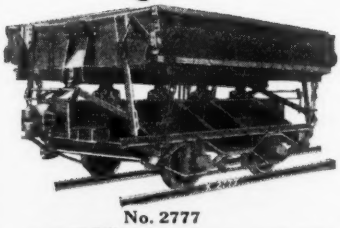
Pulverized material is distributed from the central pulverizing plant through standard pipe lines to any number of bins, irrespective of location, and makes possible the distribution of this material to widely separated and isolated storage bins.

The essential elements include a pump, which delivers the material directly to various service bins through the pipe line and diverting valves. (An electro-pneumatic switch and signal system indicate the amount of material in each bin and the flow is automatically directed to any point from the central switch board.

Write us for full particulars.

FULLER-LEHIGH COMPANY
FULLERTON, PA.

The "good old days" are gone



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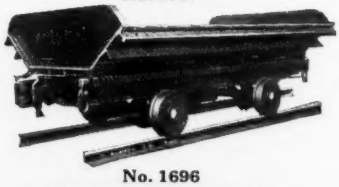

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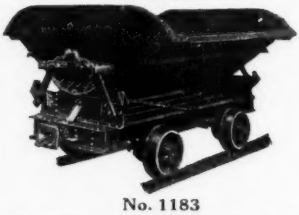


No. 1183

Today speed and output spell profits—and good cars are imperative.

Koppel Quarry Cars, made in many types and capacities, will give you long wear, low upkeep and render pleasing, satisfying service, because they are actually designed and built especially for Quarry duty and to meet the most severe conditions.

Our sales engineers are at your disposal.

Koppel Industrial Car & Equipment Co.
KOPPEL, PENNA.

Rails Switches
Frogs Track

KOPPEL

SALES OFFICES:
Pittsburgh, Chicago, New York, San Francisco

KOPPEL *cars and tracks for* **QUARRIES**

EASTON

ANNOUNCES

The Easton Car and Construction announces the establishing of a general office and works at Kansas City, Mo.

This new plant will serve the Mid-West and Western Part of the United States with typical Easton speed and co-operation.

The same Easton designs, plans and blueprints—the same Easton quality of workmanship—the same Easton sales policies will be followed at the Kansas City Works.

Inquiries may be addressed to either office.

EASTON CAR & CONSTRUCTION CO., of MO.
211 Scarritt Building
KANSAS CITY, MO.

EASTON CAR & CONSTRUCTION CO.
EASTON, PA.

EASTON CARS
FOR EVERY PIT MINE & QUARRY

You Wouldn't Use a Ten Cent Stamp—

to carry a letter requiring only two cents postage, simply because a ten cent stamp is all you happen to have. You would buy a two cent stamp.

And you need not use a large excavator which you already have, to do your light work, which requires only half its capacity, when you can do the same work more efficiently and economically with—

THE INSLEY EXCAVATOR

The Insley is designed and built for light work—street and road grading, sewer and drainage ditching, basement and cellar work, and material handling—upon which you can neither afford to buy nor use a large excavator.

It is of low first cost, and low operating cost, and will handle both a class and quantity of work which is out of all proportion to its size.

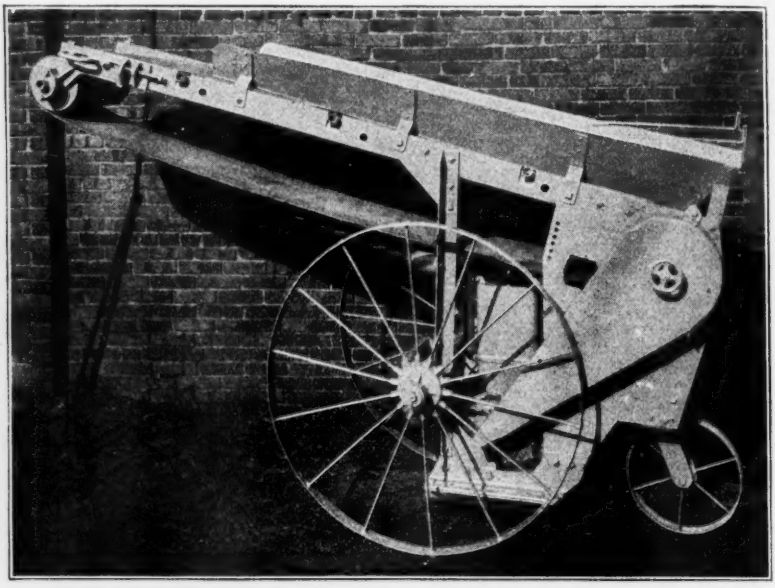
It embodies refinements which you are accustomed to think of in connection with large and expensive machines, such as a Buda power plant, capable of handling any loads put upon this machine, and full crawler traction, giving the machine the greatest flexibility.

The Shovel, Ditcher, Skimmer Scoop and Crane Attachments are all interchangeable, so that the Insley is an all-round machine, and one which you cannot afford to be without.

INSLEY MANUFACTURING COMPANY

Engineers and Manufacturers

INDIANAPOLIS



Efficient, Economical Loading

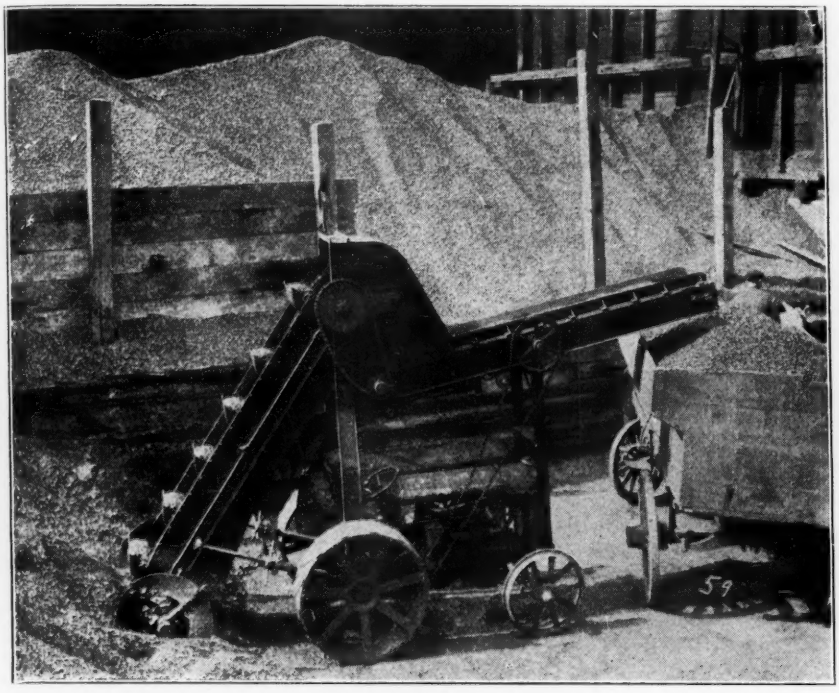
WHERE you have much loading of sand and gravel, crushed rock, phosphate, concentrates, fertilizer, gypsum, bulk lime, cement, coal, ores, and other materials, the Ottumwa Box Car Loader is highly efficient and economical.

The conveyor is adjustable and is easily handled by one man. The Ottumwa is manufactured with electric or gasoline power and the motor or engine is protected from dust, dirt, and grit. Roller and ball bearing throughout; latest improved Alemite Greasing System.

Proved savings result from the Ottumwa. It eliminates loading gang, reduces costs, prevents delays, increases capacity, pays dividends, and builds business.

Write for full information and prices without obligation. The Ottumwa will put dollars in your safe.

OTTUMWA BOX CAR LOADER CO.
OTTUMWA, IOWA



A Time and Money Saving Loader

Self-Feeding, Crowding, Digging

Speed, reduction of human labor, and steady operation in loading not only cut loading costs but also effect considerable saving in delivery costs.

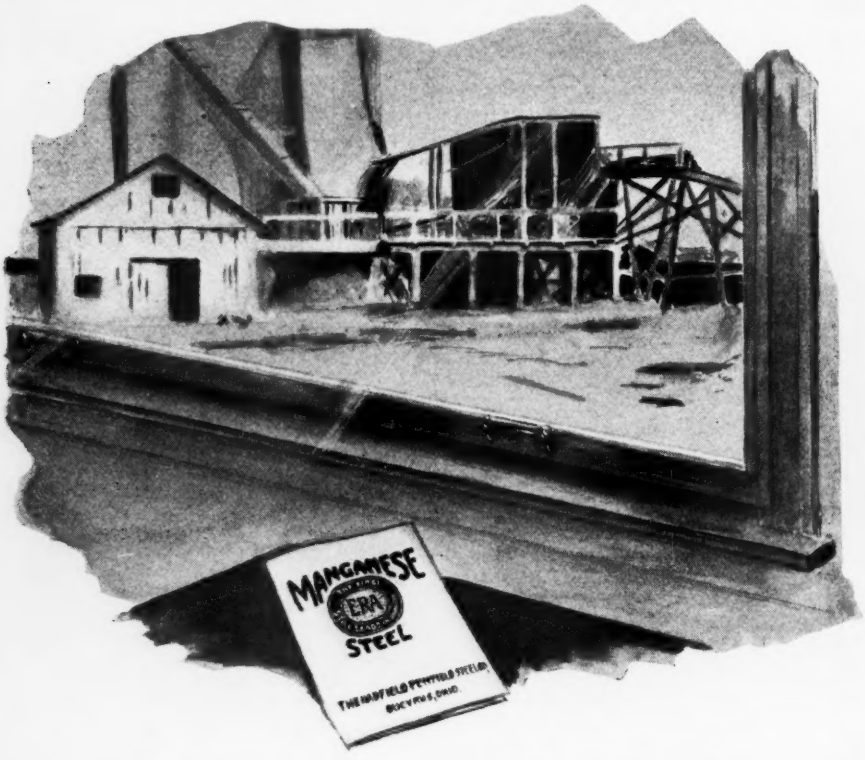
The Specialty Fordson Loader through its self-feeding, crowding and digging features eliminates all hand labor, except operator, reduces loading costs to a minimum and loads ten times faster than by hand.

The operator has full easy control of the machine. He can crowd when buckets are in operation, independent of reverse gear in tractor. He crowds the loader two inches, or any distance—and he does the whole job of loading with ease and speed.

You should know more about the big economy and advantages this efficient loader offers. Write today for bulletins or see any Ford Dealer.

SPECIALTY ENGINEERING CO.

Allegheny & Trenton Ave. **Philadelphia, Pa.**



Breakdown Insurance For Equipment

Mid-season breakdowns are too expensive—the loss in time, money and production are too big a setback not to be guarded against.

You can minimize the danger of mid-season delays by equipping the wearing parts of your equipment with "Era" Manganese Steel Parts.

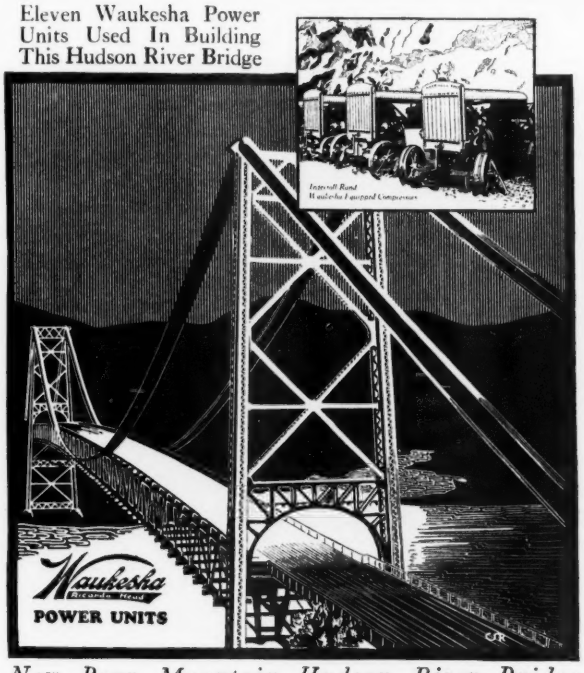
"Era" Manganese Steel will stand up under abrasive wear as no other metal can. And as the season advances, and the going becomes harder, "Era" Manganese Steel grows tougher, so that in each succeeding month's service the wear grows less.

"Era" repair parts are true, uniform and correctly made. And by ordering "Era" repair parts you get what you want, when you want it, at a stable, reasonable price. Insure your equipment properly with "Era" Manganese Steel Repair Parts.

HADFIELD-PENFIELD STEEL CO.
Bucyrus, Ohio

MANGANESE STEEL
ERA
THE FIRST - STILL LEADS IN QUALITY

Eleven Waukesha Power Units Used In Building This Hudson River Bridge



New Bear Mountain Hudson River Bridge

Where Time is MONEY

Where the penalty for lost time is money, reliability is paramount; experienced contractors understand this. The Tench Construction Co., building the New Bear Mountain Bridge over the Hudson, required a source of power of proven reliability. They chose eleven portable compressors driven by Waukesha "Ricardo Head" Motors. In all types of high-grade, power-driven machinery for contractors, you can get Waukesha "Ricardo Head" Motors.

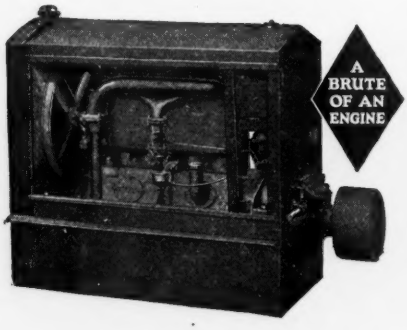
Write for the book on "Waukesha Power Units;" you will find it a directory of high-grade contracting machinery.

WAUKESHA MOTOR COMPANY

Waukesha, Wisconsin

Eastern Sales Office *Aeolian Building, 33 W. 42nd Street* *New York City*

Exclusive Builders of Heavy Duty Gasoline Engines for Nearly Twenty Years



Beaver Power Unit contains a valve-in-the-head engine. It is protected by an all-steel housing which does not interfere with the accessibility of working parts.

The Power's What Counts!

You buy an engine solely for the Power it can deliver. Compactness of design and "finished" appearance are desirable, of course, but the important thing is power,—steady and dependable power when you need and want it.

The Beaver Power Unit supplies dependable power to hoists, conveyors, pumps, compressors, crushers, to any heavy duty equipment at sand pit and quarry. It has the Steady Service Beaver Engines, with a trustworthy force-feed lubricating system, and all working parts of liberal size for a long life of service.

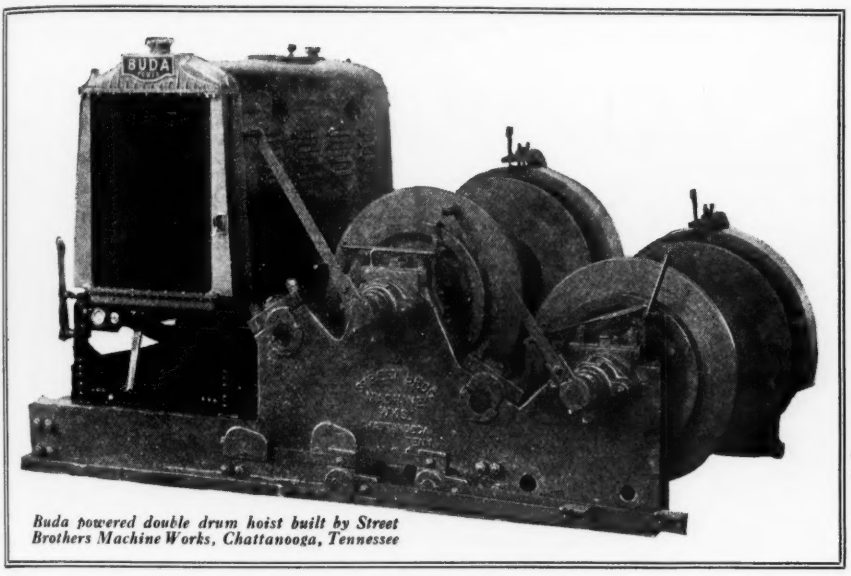
Every pit and quarry operator with Beaver Power Units at his plant is assured of dependable power, day in and day out, when and where he needs it. Write today for bulletin "Make This Power Unit Set The Pace For Your Job."

BEAVER
MANUFACTURING CO.

35 25th Street Milwaukee, Wis.

FOR STEADY SERVICE

Beaver



Buda powered double drum hoist built by Street Brothers Machine Works, Chattanooga, Tennessee

THE DOMINANT POSITION of the Buda engine in the field of industrial equipment isn't due to chance, or to salesmanship, or to advertising. It's due primarily to *performance*—a characteristic of the Buda engine which has become almost a tradition with builders of machinery.

Street Brothers are among the many outstanding manufacturers who have adopted the Buda engine for their power equipment. Their standard heavy-duty double drum gasoline hoist, pictured above, is used for derrick work, pile driving and general contractor's work. It can also be used to advantage around docks, warehouses, in stone quarries and for industrial plants.

THE BUDA COMPANY, HARVEY CHICAGO SUBURB ILL.
ESTABLISHED 1881

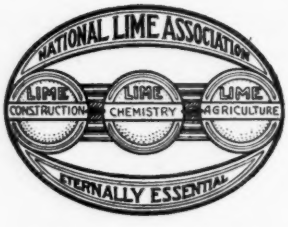
Buy only genuine Buda Parts for your Buda engine
New Parts Catalog No. 432 now ready

BUDA
The
ENGINE

NATIONAL LIME ASSOCIATION

Seventh Annual Convention

BRIARCLIFF LODGE
at Briarcliff Manor, N. Y.
May 26, 27, 28, 29, 1925



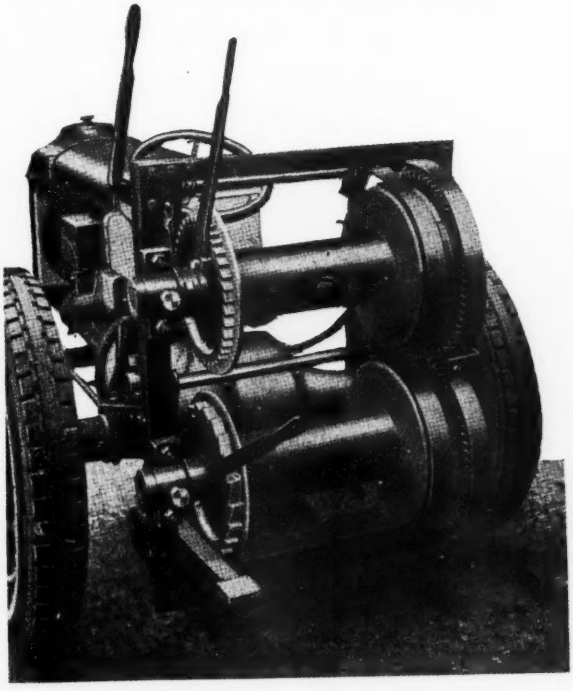
Twenty-third Annual Meeting of Lime Manufacturers

National Lime Association
918 G Street, N. W.
Washington, D. C.

This page donated by Pit & Quarry

Continental Winches

The Common Sense Winch



THE CONTINENTAL DOUBLE DRUM FRICTION DRIVE WINCH

CONTINENTAL Winches make an ideal power hoisting unit for dragline cableway and scraper. They are made in two types — friction drive and gear drive—and come in two sizes: single and double drum.

All Fordson Continental Winches are mounted on the rear axle housings, near the wheels, thus placing the weight where it should properly be. They are equipped with cut steel gears which will last indefinitely. All shaft bearings are babbited and equipped with Alemite lubricating system.

Speed ranges from 60 to 200 feet per minute on all lines. With a motor speed of 1000 R. P. M. and a load of 3,300 pounds, a speed of 200 feet per minute on the line can be had; other speeds and loads in proportion.

Every Continental Winch is unconditionally guaranteed against defective workmanship and material. Defective parts replaced F. O. B. Memphis without charge.

SPINKS SUPPLY CO.

MEMPHIS, TENN.

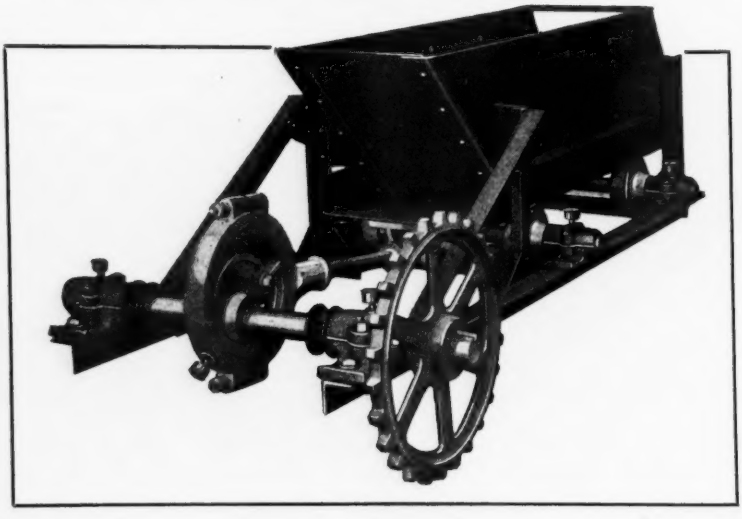
IMPROVES THE PRODUCT
INCREASES YOUR OUTPUT
CUTS YOUR REPAIR BILLS

Your conveyors—are they alternately overloaded and empty? Your screens—are they flooded one minute, idle the next? If so, just remember that machinery, like humanity, suffers from irregular feeding. A steady flow of aggregate through your plant will insure greater daily capacity, better graded material, and a lower cost per yard.

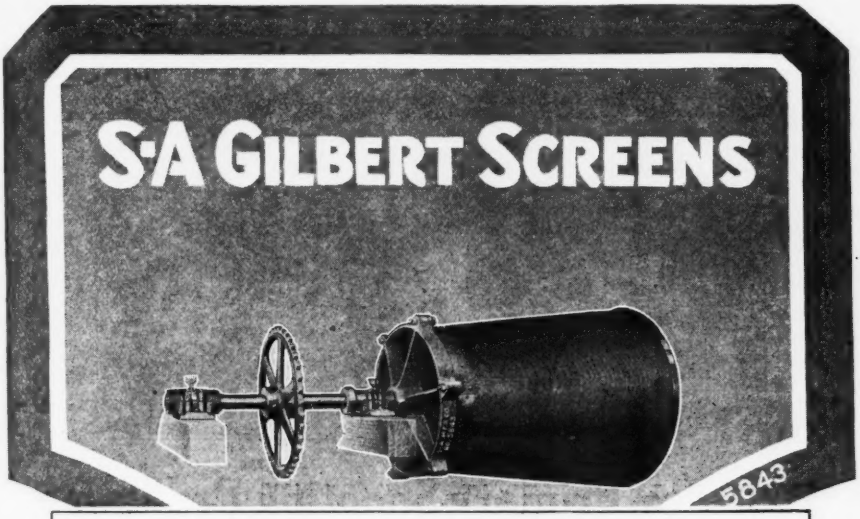
Take a look at the Telsmith Plate Feeder—an inexpensive but complete self-contained unit that will deliver your gravel or stone at any rate desired. It's just a pan, actuated by a cam, with an adjustable eccentric to change the rate of feed. You can run this device for five years without noticing either the upkeep or power consumption. It's the cheapest, yet most valuable equipment in a quarry or gravel plant —something that the up-to-date operator can't afford to go without. Glad to send you bulletin FR15.

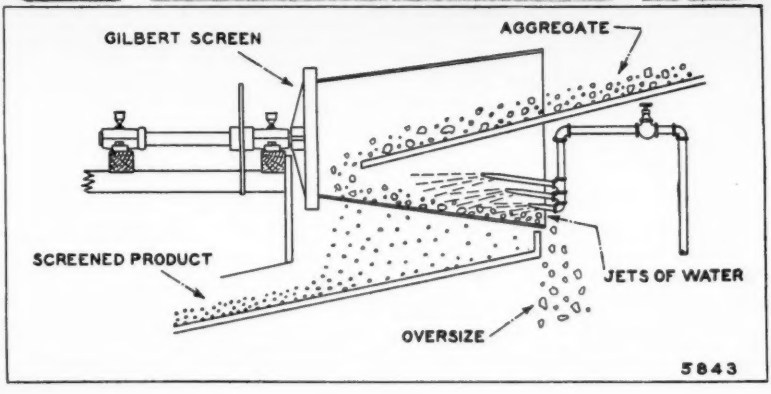
SMITH ENGINEERING WORKS

3183 Locust Street MILWAUKEE, WIS., U.S.A.



S-A GILBERT SCREENS





Gilbert Screens wash the sand and gravel as they screen. The large end is entirely open and the inside is free from obstructions which might retard screening action. Made in sizes from 48 to 84 inches in diameter.

Aggregate is delivered to the closed end and is tumbled toward the open end against jets of water. All over-size discharged at the open end has passed over screen openings and has been washed clean. Capacity is high and power consumption low.

WRITE FOR QUOTATION ON SCREENS, SETTLING TANKS OR ON A COMPLETELY EQUIPPED SCREENING PLANT

DESIGNERS & BUILDERS OF S-A LABOR SAVING MACHINERY

STEPHENS-ADAMSON

MFG. CO. AURORA, ILL.

Make the Primary Shooting Profitable

PRIMARY shooting frequently determines the question of profit or loss in the quarry. For years many quarry men have depended upon Grasselli Explosives for results with a minimum of secondary blasting.

The various grades of Grasselli Explosives enable you to choose a grade that will give you highly satisfactory results. If you want a high speed, shattering blast to break the stone fine, there is a grade of Grasselli Explosives that will do it; if you want a slow, heaving action with less shattering, you can get that too.

Our Field Man now traveling in your territory will gladly help you select the correct grade for getting the results you want with the first shot. His observations and suggestions may help in determining the question of profit or loss in your blasting operations.

He'll come when you want him. Just write, wire or phone.

THE GRASSELLI POWDER COMPANY

Main Office: Cleveland, Ohio

Branches:
Philadelphia
Bluefield, W. Va.
Birmingham
Wilkes-Barre, Pa.
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The Grasselli Powder Co., of Florida, Miami, Florida

GRASSELLI EXPLOSIVES

Free Service to our readers

For the convenience of readers who are in the market for equipment, our "Free Service" department will furnish on request any information, catalogs and prices on any machinery, equipment or supplies used in pits and quarries. The coupon below makes it easy for you. Simply check, sign and mail.

Pit & Quarry, Rand McNally Bldg., Chicago, Ill.

Pit and Quarry, Research Department,
Rand McNally Bldg., Chicago, Ill.

WE ARE IN THE MARKET for the items checked below, and would be glad to receive catalogs, prices or other information.

- ☐ Agitators
- ☐ Air Compressors
- ☐ Air Compressors, Portable
- ☐ Babbitt Metal
- ☐ Baffles
- ☐ Bag Filling Machines
- ☐ Bag Sewing Mach.
- ☐ Bags, Cotton
- ☐ Bags, Paper
- ☐ Barges
- ☐ Barrels, Steel
- ☐ Belt Fasteners
- ☐ Belting, Conveyor
- ☐ Belting, Transmission
- ☐ Bin Gates
- ☐ Bins, Clay Tile Storage
- ☐ Bins, Concrete Storage
- ☐ Bins, Steel Storage
- ☐ Blasting Fuses
- ☐ Blasting Powder
- ☐ Block Machinery, Concrete
- ☐ Boiler Compound
- ☐ Boiler Skimmers
- ☐ Boilers
- ☐ Brick Machinery, Concrete
- ☐ Buckets, Conveyor
- ☐ Buckets, Grab
- ☐ Buildings, Portable
- ☐ Burners, Oil
- ☐ Cable Coatings
- ☐ Cableways
- ☐ Car Movers
- ☐ Car Pullers
- ☐ Car Replacers
- ☐ Car Wheels
- ☐ Cars, Bottom Dump
- ☐ Cars, End Dump
- ☐ Cars, Side Dump
- ☐ Cars, Steel Gondola
- ☐ Castings, Special Metal
- ☐ Chain Drive
- ☐ Chain, Conveyor
- ☐ Chain, Steam Shovel and Dredge
- ☐ Chaser Mills
- ☐ Chutes and Liners, Metal
- ☐ Classifiers
- ☐ Clips, Wire Rope
- ☐ Clutches
- ☐ Controllers, Electric
- ☐ Conveyor Equipment
- ☐ Conveyor Rollers
- ☐ Couplings, Flexible
- ☐ Cranes, Electric Traveling
- ☐ Cranes, Jib
- ☐ Cranes, Locomotive
- ☐ Cranes, Traction
- ☐ Crusher Parts
- ☐ Crushers, Disc
- ☐ Crushers, Gyratory
- ☐ Crushers, Hammer
- ☐ Crushers, Jaw
- ☐ Derrick Swingers

(Continued on next page)

- ☐ Derricks
- ☐ Dippers
- ☐ Draglines, Cableway
- ☐ Draglines, Revolving Boom
- ☐ Dragline, Scraper
- ☐ Dredges, Dipper
- ☐ Dredges, Land
- ☐ Dredges, Sand Suction
- ☐ Drill Steel
- ☐ Drilling Contractors
- ☐ Drill Sharpening Machines
- ☐ Drills, Blast Hole
- ☐ Drills, Hand Hammer
- ☐ Drills, Tripod
- ☐ Dryers, Sand and Stone
- ☐ Dry Pans
- ☐ Dump Wagons
- ☐ Dust Collecting Systems
- ☐ Dynamite
- ☐ Dynamos, Electric
- ☐ Economizers, Fuel
- ☐ Elevating Equipment
- ☐ Engineering Service
- ☐ Engines, Gasoline
- ☐ Engines, Hoisting
- ☐ Engines, Hydraulic Pumping
- ☐ Engines, Oil
- ☐ Engines, Power Plant
- ☐ Engines, Steam

Firm Name .....

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Remarks .....

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- ☐ Feeders
- ☐ Fire Alarms
- ☐ Fire Alarm Systems
- ☐ Fire Brick
- ☐ Frogs and Switches
- ☐ Fuses, Blasting
- ☐ Gas Producers
- ☐ Gears
- ☐ Generators, Electric
- ☐ Grapple, Stone
- ☐ Grate Bars
- ☐ Grates
- ☐ Gypsum Separators
- ☐ Hoisting Engines
- ☐ Hoists, Chain
- ☐ Hoists, Derrick
- ☐ Hoists, Drum
- ☐ Hose, Sand Suction
- ☐ Hydrators
- ☐ Hydraulic Mining Nozzles
- ☐ Hydraulic Pipe
- ☐ Hydraulic Pumping Engines
- ☐ Hydraulic Valves (Pulpit and Indicator)
- ☐ Idlers, Belt Conveyor
- ☐ Industrial Railway Systems
- ☐ Kettles
- ☐ Kilns, Cement
- ☐ Kilns, Lime
- ☐ Lights, Carbide
- ☐ Linings, Bag and Barrel
- ☐ Loaders, Bin, Portable
- ☐ Loaders, Boom and Bucket
- ☐ Loaders, Box Car
- ☐ Loaders, Conveyor
- ☐ Locomotives, Electric
- ☐ Locomotives, Gasoline
- ☐ Locomotives, Steam
- ☐ Locomotives, Storage Battery
- ☐ Log Washers
- ☐ Lubricators
- ☐ Magnetic Separators
- ☐ Manganese Steel
- ☐ Manganese Steel Parts
- ☐ Metal, Babbitt
- ☐ Metal, Perforated
- ☐ Meters
- ☐ Mills, Chaser
- ☐ Mills, Tube
- ☐ Mixers, Concrete
- ☐ Mixers, Plaster
- ☐ Motors, Electric
- ☐ Motors, Gasoline
- ☐ Motor Truck Dump Bodies
- ☐ Motor Trucks
- ☐ Nozzles, Hydraulic Mining
- ☐ Nozzles, Suction Screen
- ☐ Oil Burners
- ☐ Oils and Lubricants
- ☐ Perforated Metal
- ☐ Picks and Shovels
- ☐ Pipe, Hydraulic
- ☐ Pipe, Iron
- ☐ Pipe, Spiral
- ☐ Plows
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- ☐ Powder Magazines, Steel
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- ☐ Pulverizers, Hammer
- ☐ Pulverizers, Ring
- ☐ Pulverizers, Roll
- ☐ Pump Repairs
- ☐ Pumps, Drainage
- ☐ Pumps, Dredging
- ☐ Pumps, Sand
- ☐ Pumps, Water Supply
- ☐ Pyrometers
- ☐ Rail, Steel
- ☐ Roofing and Siding (Iron, Steel, Zinc)
- ☐ Rope, Manila
- ☐ Rope, Wire
- ☐ Sand-Lime Brick Machinery
- ☐ Scales, Automatic, Conveyor
- ☐ Scales, Track
- ☐ Scrapers, Power
- ☐ Scrapers, Team
- ☐ Screening Equipment
- ☐ Screens, Perforated Metal
- ☐ Screens, Rotary
- ☐ Screens, Vibrating
- ☐ Separators, Air
- ☐ Separators, Gypsum
- ☐ Separators, Magnetic
- ☐ Separators, Sand
- ☐ Sheaves
- ☐ Shovels, Electric
- ☐ Shovels, Gasoline
- ☐ Shovels, Steam
- ☐ Speed Reducers
- ☐ Steel Barrels
- ☐ Steel, Drill
- ☐ Steel, High Speed
- ☐ Steel, Manganese
- ☐ Steel, Structural
- ☐ Stokers, Automatic
- ☐ Stone Grapple
- ☐ Stripping Equipment, Power
- ☐ Superheaters
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- ☐ Tachometers
- ☐ Tackle Blocks
- ☐ Tampers, Concrete Block
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- ☐ Tanks, Steel
- ☐ Tanks, Wood
- ☐ Ties and Timbers
- ☐ Tile Machinery, Concrete
- ☐ Track
- ☐ Track Scales
- ☐ Tractors, Caterpillar
- ☐ Tramways, Aerial
- ☐ Transformers, Electric
- ☐ Trolley Carriers
- ☐ Trucks, Electric
- ☐ Tube Mills
- ☐ Turbines
- ☐ Unloaders, Bin
- ☐ Unloaders, Boom and Bucket
- ☐ Unloaders, Conveyor
- ☐ Wagons, Dump
- ☐ Washers, Log
- ☐ Washing Equipment
- ☐ Welding Equipment
- ☐ Winches
- ☐ Wire Cloth

(See other side)

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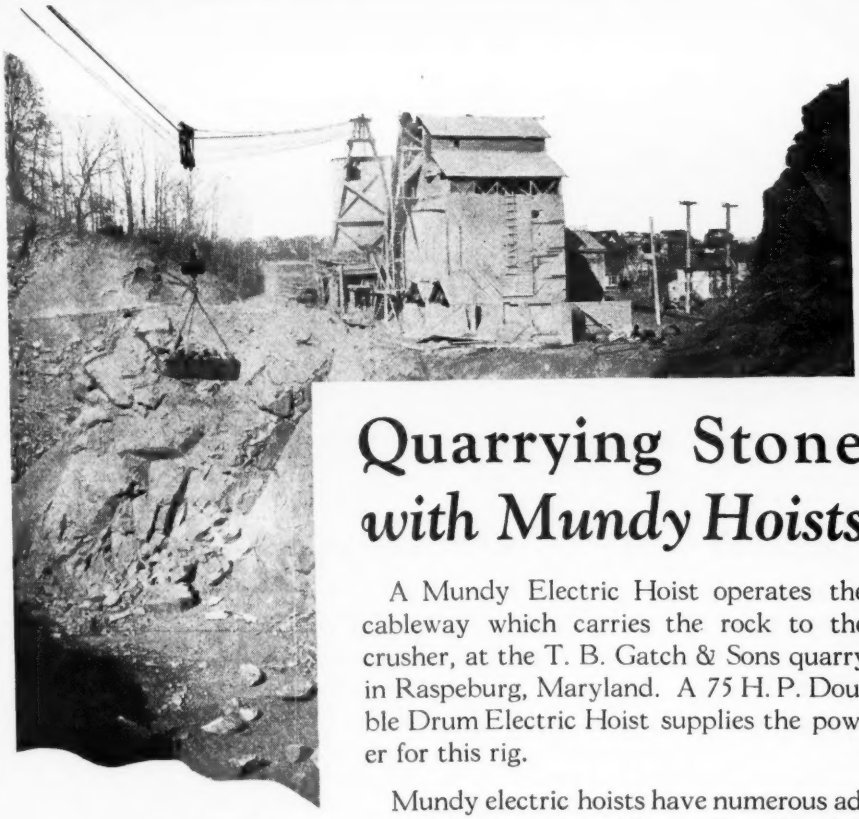
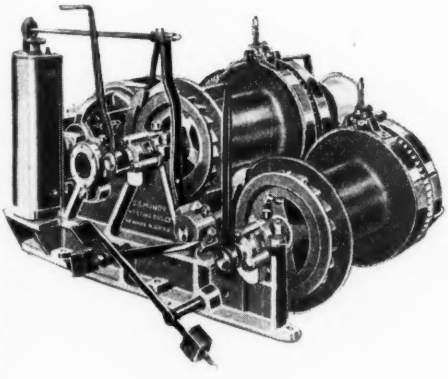


Quarrying Stone *with Mundy Hoists*

A Mundy Electric Hoist operates the cableway which carries the rock to the crusher, at the T. B. Gatch & Sons quarry in Raspeburg, Maryland. A 75 H. P. Double Drum Electric Hoist supplies the power for this rig.

Mundy electric hoists have numerous advantages over steam driven units. The first cost is less as it is not necessary to provide a boiler plant. The electric hoist is lighter for the same power and the risk of fire amid inflammable surroundings is avoided.

MUNDY TRADE MARK ESTABLISHED 1869



A 174 page book on Mundy hoisting equipment has been published. You can get your copy by dropping a card.

J. S. Mundy Hoisting Eng. Co.
Newark, N. J. U. S. A.

Agents in principal Cities

MUNDY HOISTS

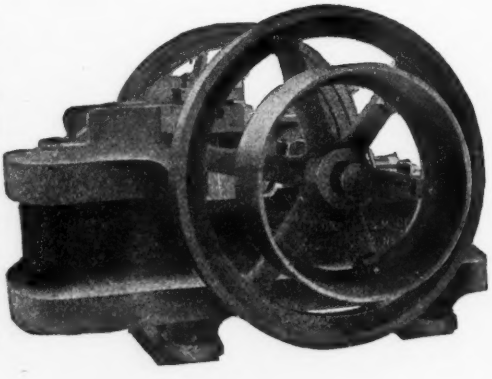
Lewistown Sand Washers—highly recommended for the preparation of GLASS SAND

IS YOUR PROBLEM LISTED HERE?

We are in position to help you meet your problem in a speedy, satisfactory manner, if it pertains to crushing, grinding, screening, washing, drying or conveying, for we manufacture a full line of this equipment for pit and quarry service.

These are reasonably priced, well built, compact outfits—efficient and quickly installed.

Will you drop us a line, stating what equipment you desire information on?



Lewistown Fdy. & Machine Co.

LEWISTOWN, PENN.

Eagle Sand and Gravel Washer

You can meet any road specifications with this Economical Washer

The Eagle Sand and Gravel Washer is a proven success—tried under various operating conditions and found efficient, economical in operation.

At Des Moines Sand & Fuel Company an Eagle Washer has taken the place of five gravel pickers, and in a few months' time saved its own cost.

Capacity of the Eagle Washer is from 250 to 300 tons per day. Approximately twelve thousands gallons of water per hour are required, the exact amount depending upon nature and amount of foreign matter to be removed. Six H. P. is sufficient to operate one washer.

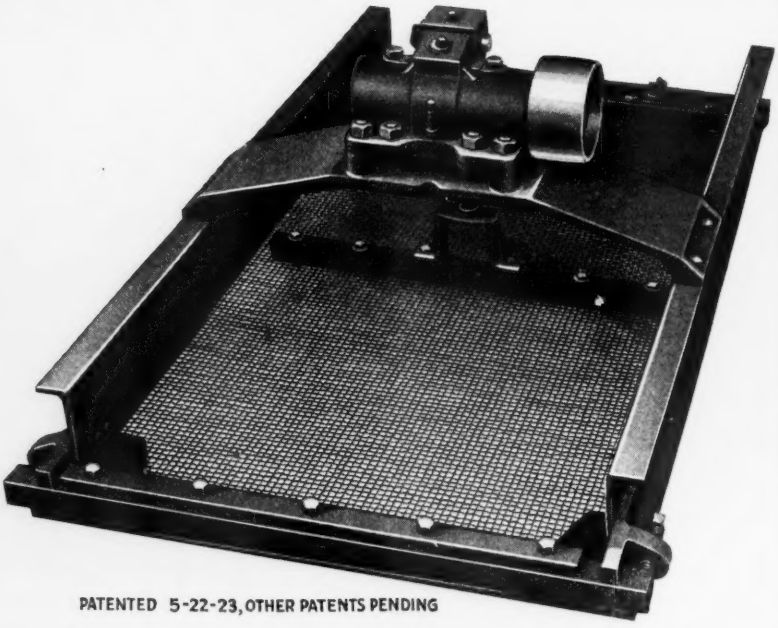
Our Sand and Gravel Washer Bulletin contains complete details. Write for your copy.

EAGLE IRON WORKS

Established 1872

DES MOINES

The New Heavy-Duty Leahy No-Blind Screen



PATENTED 5-22-23, OTHER PATENTS PENDING

THE new Improved Leahy Screen, with Heavy-Duty Vibrator is more than meeting the requirements for capacity, efficiency, and continuous service, for which this machine was designed.

About one hundred new style Heavy-Duty Leahy Screens now in operation are making even better records than the two Heavy-Duty trial screens which were operated continuously for eight months before the machine was put on the market.

For either wet or dry screening at sizes from as coarse as ¾" square mesh opening to as fine as 20 mesh, it will pay you to investigate the new Leahy screen.

Write for our bulletin No. 12

THE DEISTER CONCENTRATOR COMPANY

FORT WAYNE, IND., U. S. A.

Manufacturers of:
Deister and Deister-Overstrom Ore Concentrating and Coal Washing Tables
The Leahy NO-BLIND Vibrating Screen

Foreign Sales Department
60 Water Street, New York
Cable Address: Retsied

Just What You Want—An Excavator That Is Both Simple and Powerful—

Large Sauerman CRESCENT Scraper

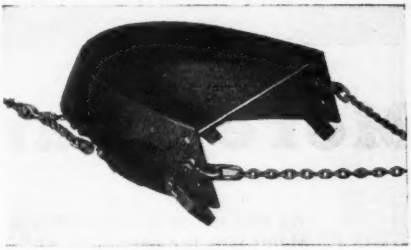
Sauerman CRESCENT

(Trade Mark Reg. U. S. Pat. Office)

Power Drag Scraper

SAUERMAN Crescent scrapers are extremely light in weight and have a powerful digging force resulting from the curved shape which gives the bucket its name—the "Crescent." This scraper is easiest to pull and cuts a straight and level path in the material it is digging.

These qualities make the "Crescent" most economical for digging sand and gravel and other loose materials, or for storing and reclaiming crushed stone, sand and gravel, coal, etc., by the power drag scraper method. Sizes of Sauerman Crescent scraper outfits are from ¼ to 6 cu. yards in standard installations; larger sizes are built on order. In addition, small outfits with portable hoists are furnished in sizes of ¼, ½ and ¾ cu. yd.



Small-size CRESCENT Bucket

Whether you have a proposition requiring as little as 50 cu. yd., or as much as 1000 cu. yd., daily, it will pay you to write for complete information on this labor-saving equipment. Ask for Pamphlet No. 24.

SAUERMAN BROS., Inc., 434 S. Clinton St. CHICAGO

A 4 Cu. Yd. CRESCENT Scraper Installation Handling Over 1000 Yd. a Day

More Than You Need

As you watch a Thew Shovel at work the most noticeable thing about it is the ease with which it meets the unusual strains.

You will see the operator put a heavily loaded dipper up and out to the fullest extent of its long reach, and—hold it there as long as necessary.

He can do this because of the ample power reserve over and above the amount required. The same is true of the crowd even when digging with the dipper extended. It's true, too, whether the power is steam, gasoline or electric.

You don't have to move a Thew up on the work so often. You can spot and shake the dipper exactly where you want it without loss of time. A Thew can wrestle the big ones without help.

And this reserve power is backed by plenty of reserve strength in all parts to meet the unusual strains.

Thew users will confirm these statements. Ask them.

THE THEW SHOVEL COMPANY, LORAIN, OHIO

Thew Shovels

Dig Faster—Last Longer

Pit and Quarry

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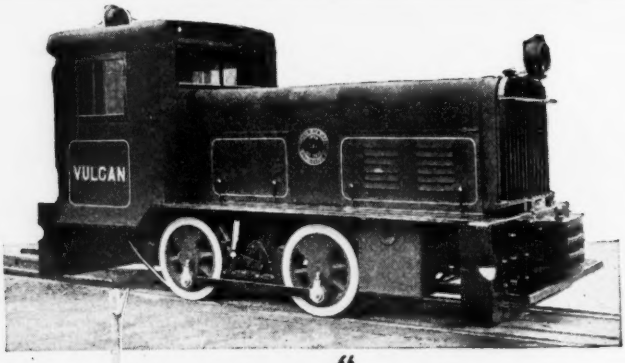

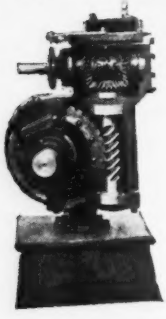

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GASOLINE LOCOMOTIVE

Pit and Quarry

A Semi-Monthly Publication for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime and Other Non-Metalic Minerals.

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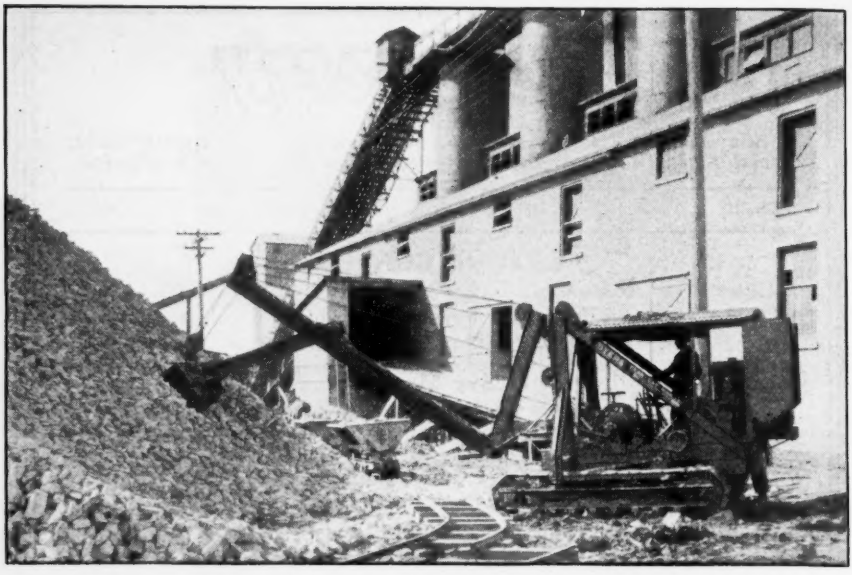

"No Other One Like It", Says This Owner

Western Lime & Cement Co. recommends Byers Bear Cat Shovel

THE value of the Bear Cat ½ yard shovel in handling limestone cannot be doubted after reading the following letter dated April 14, 1925.

"At the request of our General Manager, Mr. Geo. W. Nast, we are writing you a few words of appreciation for having sold us your Byers "Bear Cat" Shovel.

"As you undoubtedly know, this shovel is being used daily, loading limestone from stock-pile into our quarry cars. This stone varies in size from pieces approximately 3 inches in diameter, to 10 to 12 inches in diameter. We can frankly say that we are perfectly satisfied with the operation of your machine, and we feel that there is no other one like it for the money that can do this particuar work as well.

"We are able to move it around quickly and to operate it easily. It is apparently no trick at all for the man we chose to get the hang of running this shovel. He is a truck driver by trade, and we douot if he had even seen the inside of a gasoline shovel before he was put on ours.

"We again sincerely and earnestly recommend the use of your sturdy little machine to anybody that is interested."

Very truly yours,

THE WESTERN LIME & CEMENT CO.

By R. C. Robertson

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Pit and Quarry

Vol. 10 **Chicago, Ill. May 15, 1925** **No. 4**

Utilizing the Instincts

SUCCESSFUL executives find that their greatest problem is dealing with human beings. That is the one thing which distinguishes the executive from the other members of the management. He does not deal directly with materials or machines; he deals with men. He succeeds by making people want to do things, not by doing them himself. Hence he studies human nature in order to determine why people want to do things. Work is done by muscles which in turn are controlled by the brain. The brain of the individual workman gives the orders to his muscles. Therefore the executive's problem is how to influence the minds of men and thereby direct their muscles. The executive who utilizes all of the mental energy in his plant for increase of production will attain results far beyond those reached in the average organization.

Most of our actions are due to our instincts which are inborn tendencies to react to a certain influence always in the same way. The action takes place without consideration on our part. To act counter to an instinct requires a certain amount of will power. The old theory, that people always seek the greatest happiness with the least effort, was based on the supposition that we usually think out an action and perform it for a special reason. We now know that only a small percentage of human actions are the result of long processes of reasoning. While man is a reasoning being, he also possesses practically every instinct found in lower animals and some others that are apparently peculiar to him. Although the instincts are very slow to change, the fact that they do change is responsible for a great deal of the conservation of human nature. That they can be directed and utilized is the fact of importance to the executive. Those instincts which concern him most in his handling of men are the instincts of craftsmanship, gregariousness, subserviency and leadership.

Life has been defined as a "tendency leading a substance to transform its environment into forms that satisfy its desires." With man this tendency has been a potent force that has led him to conquer the forces of nature. An industrial plant is an expression of this same instinct of creation, or craftsmanship. A law of the instinct of craftsmanship is that the instinct finds satisfaction when the muscles are carrying out an idea which the mind has shared in forming. The instinct requires that the muscles shall be directed by the brain. The law of management on the other hand requires that one mind direct the muscles of the workers. Hence there is a conflict which the executive must solve. If the workers lose interest in their work, if they have no pride in their skill, or if they are without the incentive to work which is necessary for production, there is evidence that the instinct of constructiveness has been hampered. The muscles which perform the work must be reached in some way through the brain that directs those muscles. The brain of the worker must wish to work. The highest type of craftsmanship craves skill; the lowest type craves approbation only.

Applying these principles to the industrial plant, the executive finds that his employees do more satisfactory work when they realize that an effort is made to increase their skill. The men know when they are working for a competent and wise executive; they also are aware of the wastes of poor management. Their skill is not improved in a plant where there is a bad layout, delay in delivery, inefficient equipment, and lack of planning. The instinct of craftsmanship is gratified, on the other hand, in an organization where employees are encouraged to give

expression to their ideas. Improved methods, inventions, suggestions regarding processes may result from the instinctive desire of the employee to create or to construct. While in many cases these suggestions are of little value to the management, the mental energy expended by the workman brings practical returns in the interest which is put into the work. In this connection it is important to note also that the element of fatigue is pertinent. The energy which is expended in recreation would result in great exhaustion if it were expended in labor; and in the same way the exertion which the workman puts into a job in which he has no interest tires him far more than that which he expends on work which he enjoys. Fatigue is frequently a mental condition which may be eliminated if the worker's skill is utilized in labor that is satisfying to him.

There are in all industries many jobs which in themselves fail to gratify the instinct of craftsmanship. Operating a machine often means monotonous repetition of motion which might easily become deadening in its effect upon the worker. There are, however, ways of making such work satisfactory. The element of speed resulting from perfection gives incentive to the worker. Instructing a man in ways of eliminating lost motion and of perfecting the operation gives interest even to the monotonous job. Of course, a man with evident creative power of mind will not be one who will be kept at this kind of work. For men of a small amount of mental activity it is easy to give to this work an element of interest.

Another instinct which the executive utilizes in his handling of men is gregariousness or the group instinct. Man likes a close union with his fellows; he is social. Understanding how fundamental this is, the executive will keep in a gang individuals who are naturally harmonious. Among foreign workmen those of the same nationality will work more efficiently if they are kept together. Group action should be encouraged and directed rather than crushed. The instinct cannot be destroyed and will otherwise find an outlet in some method that may prove to be destructive to the industry.

Executives who have understood this instinct have afforded expression for it in plant councils and group organizations. Minor executives may be called together for discussion and consultation, and they in turn will consult with groups over which they have supervision. Even a gang boss will make no mistake if he occasionally gathers around him a group of seemingly ignorant workmen and discusses the job with them. A foreman who is unable to do this because of fear or lack of initiative is either incompetent or is himself in need of suggestion and training from his superior.

There are two exactly opposite instincts in human beings which can be utilized by the executive for the benefit of the organization. One is subserviency and the other is leadership. The tendency to follow the leader, to be a part of a group and to act as a group is found not only in human beings but in all animals that have the gregarious instinct. It gives unity to the group, insures simultaneous response to danger, and gives to the whole group the protective foresight of the leader. When this instinct is strongly developed in individuals, it functions in such a way that they not only are easily led, but they enjoy being led. They get a certain satisfaction out of following their leader; they feel a pride in his power to direct them. They become a potent force, ready to act in accordance with his decisions.

Leadership is a quality which is more rarely found. It is the exceptional individual who possesses it and who can arouse the instinct of following in his fellows. The leader will have initiative; he will start things. He will be quick, courageous, and enthusiastic. He will acquire power of organizing; he will accept responsibility; he will develop foresight. He may be of inestimable value to the organization; he may be exceedingly harmful. Whether or not he is valuable depends almost entirely on the executive. The instinct of leadership can be utilized or it can be lost. The responsibility lies with the chief.

Every group of workers represents all of the fundamental qualities of human beings. As the executive studies the personnel of his organization, he knows that his success depends on his ability to make use of the material.

Efficient Handling of Heavy Material In a New Granite Cutting Mill

Written expressly for PIT AND QUARRY by F. A. Westbrook*

THE granite cutting mill of the Presbrey-Leland Company at Brattleboro, Vermont, is the newest and probably the most up-to-date mill of its kind now in operation. One of the most important considerations in laying out a plant of this kind is to provide for the efficient handling and routing of the very heavy materials used. The careful attention which has been given to the subject has resulted in the possibility of employing the most highly skilled type of well paid labor, peculiarly necessary in this industry, and of still keeping production costs at such a low figure that the sales department is not unduly hampered.

The building where the stone cutting operations are carried on is divided into three bays running from east to west for the full length of the structure. This is something like three hundred feet long. The north and central bays are each fifty feet wide and the south bay twenty-one feet wide. The raw material comes in at the west end of the north bay, progresses to the east end, and then comes back along the central bay or the south bay, depending on the nature of the job.

Each one of the bays has its own travelling crane, a forty ton crane in the north bay, a twenty ton in the central bay, and a five ton in the south bay. The reason for the different sizes of cranes in the different bays will become apparent. Fig. 1 shows the general layout of the floor space and the routing of the materials.

As the plant is located adjacent to the main line of the railroad, it is an easy matter to bring the large quarry blocks of granite in on flat cars over a siding from the Company's quarries at Dummerston, Vermont, located about seven miles away.

*Consulting Engineer.

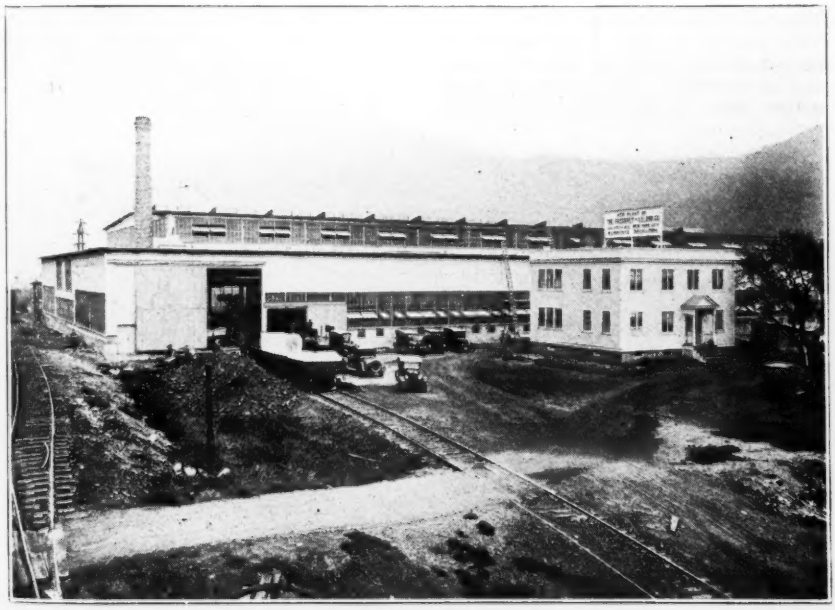


Fig. 2. General View of Plant Showing Flat Car with Quarry Blocks of Granite About to Enter West End of Building. The Main Line to the Railroad is Just to the Left of the Picture.

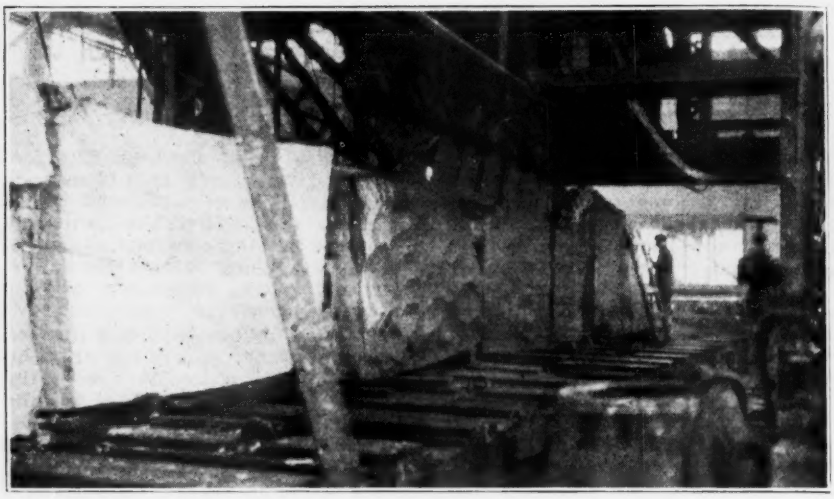


Fig. 3. Granite Saw, Showing the Saw Blades and Blocks on the Travelling Carriage.

The tracks for these cars enter the west end of the building as shown in Fig. 1 and run to the north bay. Here the blocks are picked up by the forty ton crane and deposited on the moving platform of the Chase saw where they are cut up into various sizes according to the jobs for which they are destined.

The pieces of sawed up block are then taken up again by the forty ton crane as shown in Fig. 2 and set aside for the time being, or they are deposited on one of the surfacing machines.

The heaviest load which it is ever necessary for the large crane to carry is about fifty tons, but, as this happens only fifteen or twenty times a year and as the cranes have a factor of safety of five, it was felt that this occasional overloading was not objectionable and that the first cost and operatin expense of a larger size crane was therefore unjustifiable.

If, after leaving the saw, one of the

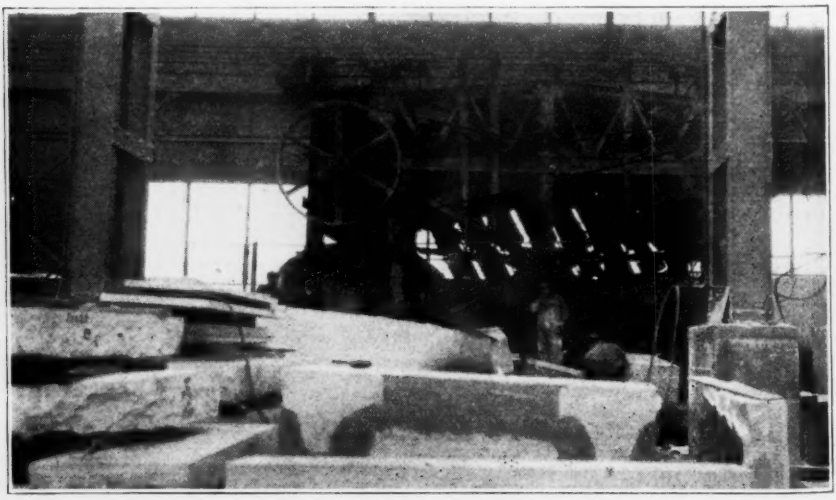


Fig. 4. Side View of Saw.

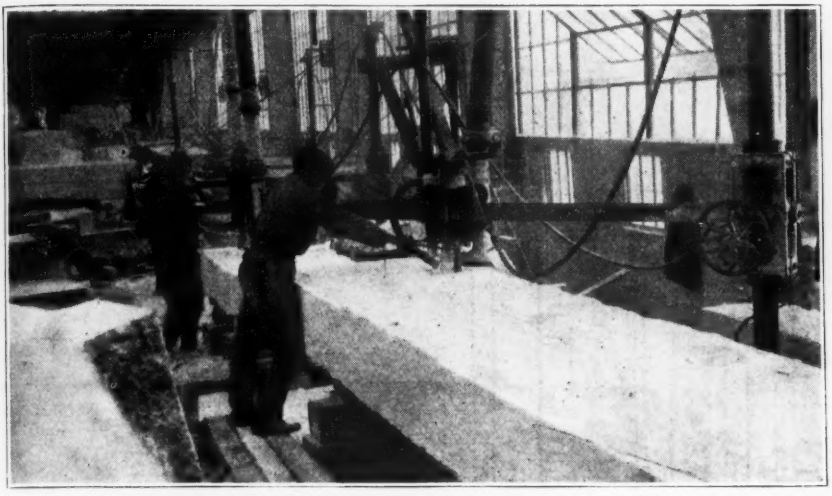


Fig. 5. The Surfacing Machines. The Surfacing is Done by Pneumatic Tools. Operators Wear Goggles.

pieces of granite is, for instance, to be made into a column of round cross-section, it will first be roughed out by hand in the same bay, and then it will be taken by the large crane to the east end of the bay where it will be transferred to the middle bay and placed in the cutting lathe on which it will be more smoothly rounded. This is done by steel shot ground against the granite by steel discs. Alongside of this machine is the polishing lathe where the stone is brought to a smooth finish with steel shot ground against the column with heavy iron blocks. Should a polish be required, the process is continued with carborundum grains and finally with tin oxide to give it a gloss. All this machinery is located at the east end of the central bay, and all heavy pieces which do not require inscriptions progress down this central bay back toward the boxing and shipping department at the west end of the same bay, adjacent to the railroad

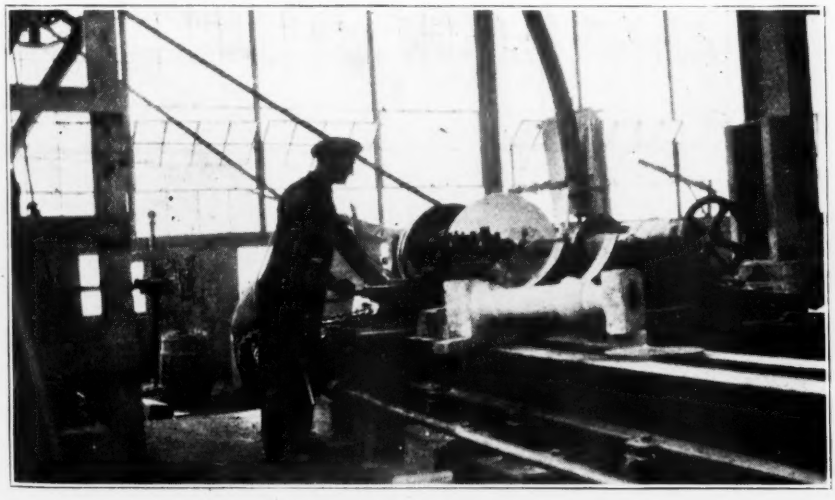
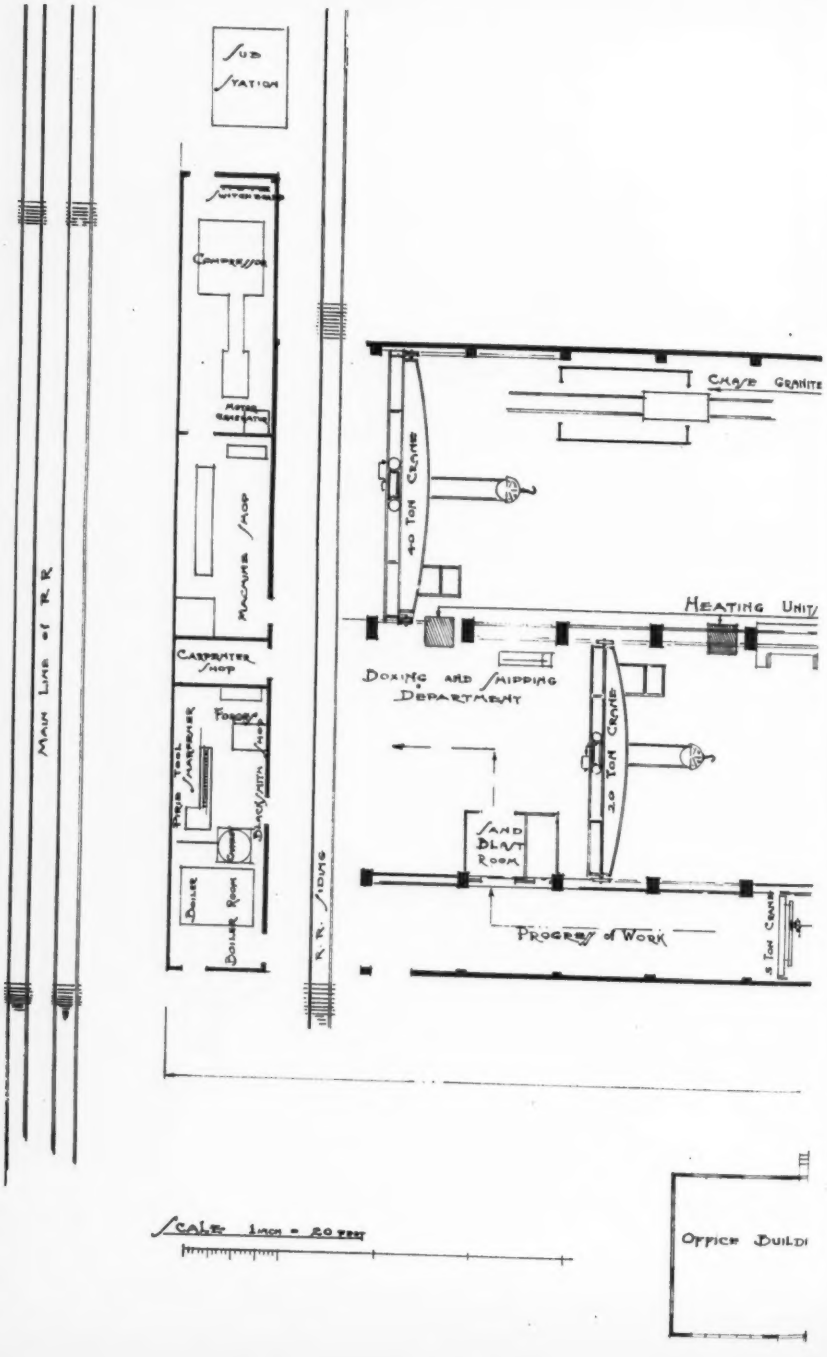
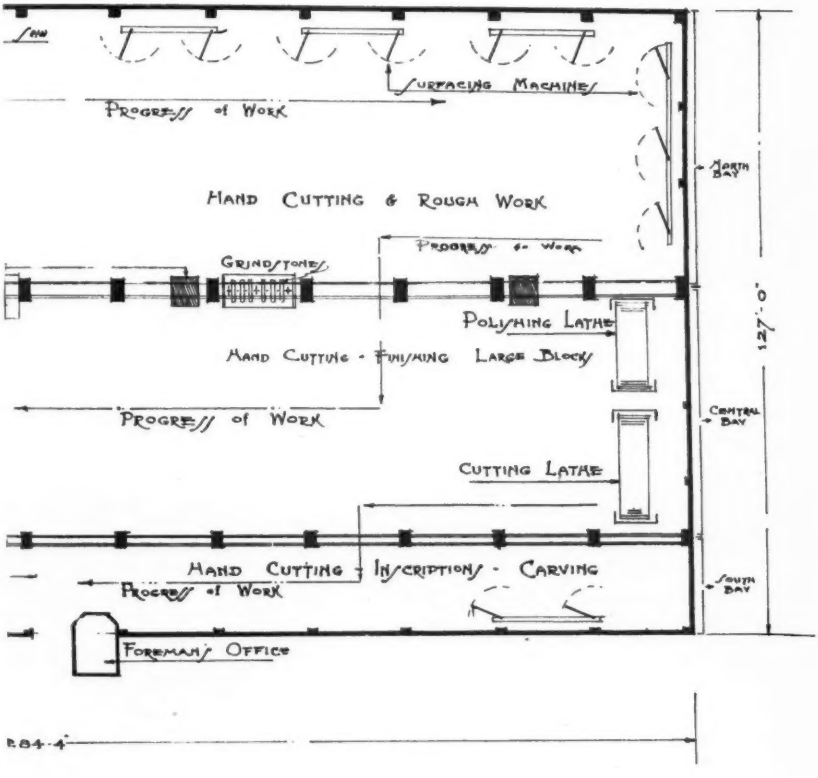


Fig. 6. The Granite Lathe in Operation.


SUB STATION
COMPRESSOR
MACHINE SHOP
CARPENTER SHOP
FORGE SHOP
BLACKSMITH
BOILER
BOILER ROOM
MAIN LINE OF R.R.
R.R. SIDING
CHASE GRANITE
40 TON CRANE
HEATING UNIT
DOXING AND SHIPPING DEPARTMENT
SAND BLAST ROOM
20 TON CRANE
PROGRESS of WORK
5 TON CRANE
SCALE 1 INCH = 50 FEET
OFFICE BUILDI



- FIGURE 1 -
PLAN OF FLOOR SPACE
SHOWING HOW WORK PROGRESSES

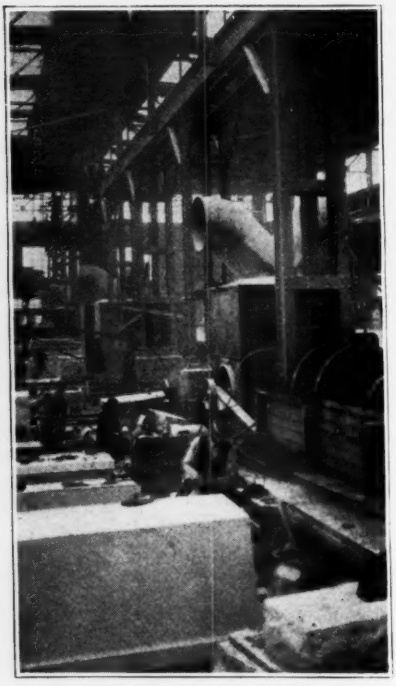


Fig. 8. Close View of Steam Hot Air Heater Looking West Along Central Bay. Artificial Heat is Necessary Because of the Very Cold Winters.

tracks already mentioned. The work done in this central bay is practically all by hand, with the aid of pneumatic hand tools, and consists of shaping and dressing down to proper dimensions the pieces of stone coming from the sawed-up quarry blocks. Consequently the twenty ton crane is large enough to handle all of this material.

In the third, or south bay, is the department for the lighter pieces which require inscriptions or carving. The edges and ends are also trimmed here. The progress of the work carries the material from east to west as in the central bay. The five ton crane is all that is needed to move about these pieces.

It might be well to note here that stones are moved from one bay to another on a truck pushed by hand on tracks extending across the east end of the building.

Near the west end of the south bay and between it and the central bay is the sand blast room, as shown in Fig. 1. The stones enter this room from the south bay and emerge into the shipping department in the central bay, also shown in Fig. 1. All finished stones are given a final touch with the sand blast. There are a great many of these small pieces passing this point so that the crane in this bay is very busy indeed.

In order to get a stone into the sand blast room it was formerly necessary

Fig. 7. Looking West Down North Bay Showing Granite Saw in Right Background and 40 Ton Travelling Crane Lifting a Medium Average Size Block.

to lift it by means of the crane on to a car which ran on tracks extending from the south bay into the sand blast room and into the central bay. At that point it had to be lifted off the truck by the twenty ton crane, and each time the truck was moved it took from two to four men to push it. In other words this was a bad point of congestion, and the remedy which was applied is very interesting as well as suggestive for other men who have to keep things moving smoothly through their plants.

In order to carry on the sand blast operation efficiently it is naturally necessary to send in one block after another without delay and also take them away with similar dispatch. Waiting for a crane to become available at either end of the sand blast room is fatal to efficiency.

A number of strong platforms were built, on which the blocks of granite could be set by the five ton crane near the entrance to the sand blast room. An industrial lift truck was purchased by means of which it is a simple matter to pick up the stones as they are wanted, deposit them in the sand blast room, and then remove them into the shipping department. This relieves the cranes and it is of course much more economical to buy one truck than one or two travelling cranes, not to mention the fact that one man can operate the truck

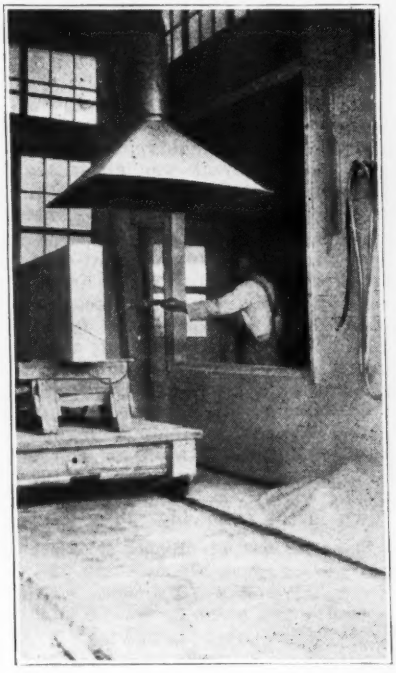


Fig. 9. The Sand Blast Room. In Actual Practice the Man With the Hose Stands Behind a Fine Wire Mesh as a Protection From the Dust

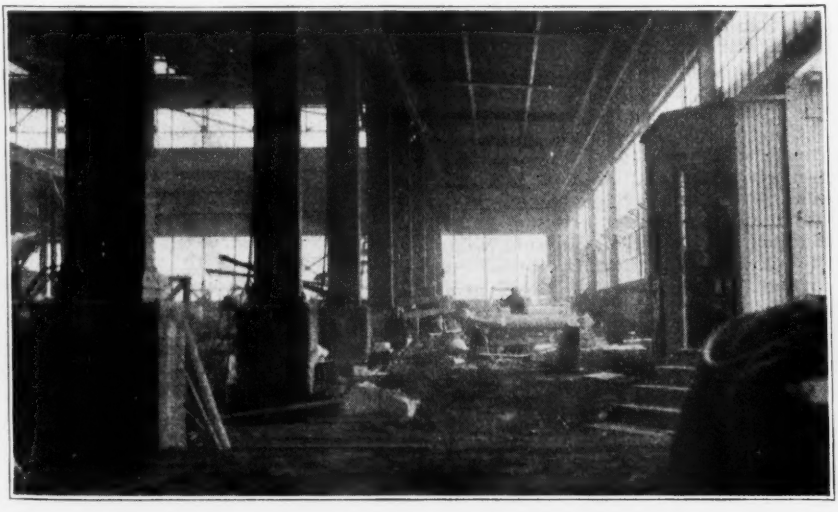


Fig. 10. Looking East Along South Bay Showing the Office of the Foreman of the Cutting Department on the Right. This Office is Located in the Middle of the Bay.

whereas it formerly took several men to push the car running on tracks.

To still further facilitate the sand blast operation and relieve the cranes the tops of these platforms are made so that they can be revolved in order that all sides may be reached by the blast. Formerly it was necessary to push the truck out and turn the block around with the help of the crane.

Although all the other motors in the plant are alternating current motors, the three travelling cranes are operated by direct current because by doing so it is possible to vary the speeds according to the load; whereas with alternating current only the full load speed is possible unless complicated with extra windings, clutches or gears. As the cranes are loaded to capacity not more than 25 per cent of the time, the advantage of using direct current is obvious. This is shown in the following table:

Speed in Feet per Minute at Which Crane Operates

	40 Ton Crane		20 Ton Crane	
Load	D.C.	A.C.	D.C.	A.C.
Lifting—light	30	13	50	20
Lifting—full	13	13	20	20
Bridge travel—light .	300	250	350	300
Bridge travel—full ..	250	250	300	300

The repair shop as shown in Fig. 1, is located in a separate room in one end of the building, adjacent to the switchboard and electrical apparatus room on one side and to the boiler-room on the other. With this layout it is an easy matter to carry the smoke and gases from the coal forge and oil furnace directly to the stack for the boilers and thus improve atmospheric conditions in the plant. This question of maintaining the best possible atmosphere in the plant both in regard to dust and fresh air has been given a great deal of attention because it is felt by the management, and rightly so, that this is one of the principal considerations in this industry both from the standpoint of employees' welfare and quality of product. It is particularly important on account of the long winters during which artificial ventilation must be resorted to.

The Air Lift Method of Pumping Water by Compressed Air is discussed and illustrated in a 12-page bulletin, No. 118, recently issued by the Pennsylvania Pump and Compressor Company, Easton, Pennsylvania.

A Big Hole Blasting Stunt

By A. I. Deringer, General Manager, Benton Lime & Stone Company

Last summer we loaded a shot consisting of 37 holes 5½ inches in diameter and 26 feet deep with 60 per cent and 40 per cent dynamite using countered Cordeau fuse in each hole except the last one. In this hole we used the plain Cordeau. We did not cut it but extended it from the bottom of the last hole along the top of the entire range of holes and used it as a lead to which we attached the fuses from each hole in the same manner as when setting it off with an electric current. We had only one free end of Cordeau instead of two as is usually the practice. To this free end we attached a number 6 blasting cap with two feet of cotton fuse by means of the ordinary coupling.

When all was ready we set the entire charge off by simply lighting the cotton fuse as when firing a pop shot. The result was identically the same as if electric caps had been used with electric current without having the usual wires and connections to contend with that cause so many delays and miss-fires. In small plants or where only single rows of holes are fired this method can easily and economically be employed without the necessity of electric current or blasting machines.

New Lime Plant for Seattle

Among recent incorporations is that of the Northwest Lime company of Seattle, whose holdings include limestone deposits on Orcas island, where a modern lime burning and hydrating plant is to be constructed near the village of East Sound.

The plant will consist of the usual quarry equipment, cableway, shaft kilns, hydrator and auxiliary crushing and conveying units, and will be built by the Schaffer Engineering company of Pittsburgh, with whom a $75,000 contract for the first unit has recently been closed.

One of the features of the plant will be a wire line tramway to be constructed at a cost of $12,000. Work on the first unit of the plant will be started as soon as final details in the plans have been worked out and other units will be constructed later. About 100 feet of waterfrontage will be utilized by the construction of wharves. The company has valuable limestone deposit holdings on the island, according to the officers.

Specifications of Coal for Lime Burning

Written Expressly for PIT AND QUARRY by Charles Longenecker*

BEFORE proceeding to write out specification for an acceptable coal, it will be necessary to ascertain what conditions must be met in the burning. It will be logical also to investigate the varying characteristics of coals in order that proper selection can be made. Two methods of lime burning will be considered, the vertical kiln and the rotary kiln.

It will depend largely on the use of the lime as to what per cent of impurities is permissible. In 1924, to quote from the Pit and Quarry Hand Book, "About 53 per cent of the total output was used in building, 41 per cent in chemical industries and 6 per cent in agriculture." Naturally the lime employed in agriculture need not be so pure, while that in chemical processes must be quite pure. Other uses are in textile processes, tanning, manufacture of lime brick, silica brick and in the preparation of varnishes. The specifications covering lime are of such a wide divergence that no attempt will be made to enumerate them.

The impurities depend on the use to which it is to be put. In some cases silica ($S10_2$) alumina (AL_20_3) and iron (Fe) are regarded as impurities. Sulphur is in practically all cases an impurity. Impurities may arise from the stone from which the lime is made or may be taken up in the process of burning. The American Society for Testing Materials in 1922 compiled a set of specifications covering lime for several different uses, and in later issues enlarged on this subject.

In speaking of the effects of impurities Dancaster in "Limes and Cements" states, "The nature of the fuel employed may, however, have a serious influence upon the quality of the lime produced. If the fuel contains much sulphur, the latter will oxidize into the gas sulphur dioxide (SO_2) which will combine with a portion of the lime with the formation of calcium sulphite ($CaSO_3$) which is finally oxidized to calcium sulphate ($CaSO_4$). As calcium sulphate sets more rapidly than calcium carbonate and with a different crystallization, lime containing this material does not assume the same degree of hardness which a more homogeneous material would assume. Moreover, calcium sulphate decomposes when exposed to the open air or to fresh or salt water; so that if present in any considerable quantity, it will cause the disintegration of any masonry into the execution of which it enters."

Iron as is well known discolors the lime. This element only comes in contact with the stone when burned in mixed feed kilns. In the separate feed vertical kiln and the rotary the question of impurities enters only as the ash carried in the gases is deposited with the lime. In the rotary kiln it is estimated that 40 per cent of the ash settles and becomes an integral part of the finished product. This ash of course carries the silica, iron and alumina in the coal and part of the sulphur. Some of the sulphur will be burned to SO_2 and will pass out. The analysis of the ash of coal varies widely but the following is representative:

Silica ($S10_2$)	—49.00
Alumina (AL_20_3)	—35.70
Iron Oxide (Fe_20_3)	— 7.29
Calcium Oxide (CaO)	— 3.26
Other Oxides	— 4.75

This can be compared with a high calcium lime which analyzes:

Calcium Oxide	(Ca0)	—94.80 per cent
Silica	($S10_2$)	— 3.20 per cent
Alumina and Iron Oxide		— .80 per cent
Mangesia	(Mgo)	— 1.21 per cent

Both the ash and lime contain the same elements; hence the harm from impurities is a question of quantity. The ash with the iron carries some sulphur as iron pyrites (FeS_2). This sulphur of course is deposited with the ash.

In all types of kilns it is of economic advantage to use as little fuel as possible. It is also, as is apparent, of great advantage to keep the consumption of fuel low due to less opportunity for admixture of deleterious coal ash. The less fuel the less ash.

*Engineer—Combustion Engineering Corporation.

A discussion of the properties of coal ash will throw considerable light on the quality of coal desirable for use in burning lime. The ideal coal will contain a very low percentage of ash. Coals of very low ash content are generally more costly than those of high content. Hence a balance must be struck. Very frequently it is less costly when the finished product is considered, to pay a higher price and receive a good grade of coal than to buy the high ash, high sulphur coals costing less. It is the cost of the finished product which must be controlled. Too often this apparent but frequently overlooked fact is not recognized. We all are too anxious to save a few dollars in the purchase of coal, forgetting the results from the burning.

The ash of coals varies in its constituents as well as in its percentage. A red ash indicates high iron content; and a gray to white indicates low iron. Also a high content of iron indicates a fusible ash or one which will become fluid at a low temperature. High sulphur in coal is not always an index to a fusible ash, but it generally is. As mentioned, sulphur in coal is mostly found with the iron as pyrites, but sulphur can also be found in coal as a sulphate and organically combined. That existing as a sulphate and organically can be volatilized in the burning; while that portion in the ash as pyrites is not volatilized but remains in the ash. Possibly a small portion may be volatilized when burned in powdered coal, but the portion is not large. At the proper temperature the sulphur will combine with the lime and form the sulphate. As the ash will vary in its percentage of constituents, its point of fusion will likewise vary. As a rule the fusion point of ash will range from 2000° F. to 2800° F. This is a factor which is becoming more prominent in the purchase of coals. It was not recognized formerly as it is today. If manufacturers of lime have not paid particular attention to the point of fusion of the ash of the coals they purchase, they should now do so. The large purchasers of steam coal not only demand coal of a high point of fusion of the ash but confirm it by test. Those coals of low ash fusibility clinker easily on the grates, obstruct the flow of air and carry away a very appreciable quantity of the carbon of the coal. This feature will be especially important to those manufacturers burning lime with "mixed feed." It is advisable for lime kiln operators, of whatever type of kiln, to have an analysis made of not only the coal but also of its ash, as this will be most helpful in affording a check on the most satisfactory coal for the individual plant. The manner in which the coal is burned also exerts a great influence on the effect of the ash. Where the coal is burned powdered and from 30 per cent to 50 per cent of the ash is carried out in the lime, the effect of the ash is much more harmful than when burned in a producer and practically no ash is carried into the chamber in which the lime is heated. A controlling feature in ash deposit in a rotary kiln is the fineness to which the coal is pulverized. It has been found that fine grinding is very beneficial as the ash is lighter and keeps in suspension longer and hence there is less probability of its settling in the kiln. In powdered coal firing the higher the ash fusion point the better the results.

Coal can be classified under various headings. For lime burning the anthracites, lignites and peats can be left out of consideration although the time will come when these must be given attention. We are today burning our best and most easily mined coals. The day is not far distant, as time goes, when we must accept the lower grades.

Most of the coals burned in lime kilns are of the high volatile seams as the Westmoreland and Fairmount gas grades. These coals due to the large percentage, over 30 per cent, of volatile constituents burn with a long flame and have a low ignition point.

In the separate feed vertical kilns a coal of high volatile content will burn well into the kiln. With these coals great care must be taken in supplying air sufficient to burn the tarry matters, etc. With a low volatile coal, such as is used under boilers, the heat is local to a great extent. In the Schmatolla kiln where the air is preheated by passing through the lime, first class should be obtained when burning coal of the gas grade.

The volatile constituents of coal

are the hydrocarbons. These are the methanes (CH_4) ethanes (C_2H_4) and others composed of carbon and hydrogen. It is impossible to enumerate the chemical composition of all hydrocarbons in coal gas as there is no way of separating them. These hydrocarbons vary at different times as some break down into simpler forms. In burning such coals it is imperative that the gases given off are not chilled, for if this takes place smoke will be given off. On the other hand when the gases are not burned quickly and are very hot, the hydrocarbons may break down and carbon (soot) be deposited. If the opposite is the case and the gases are chilled, tar will be deposited. In the gas producer, gas coal is the only fuel to burn. The success achieved here will depend on how efficiently the producer is operated. With the present day mechanically operated producer there is little excuse for inefficiency. The regulation of the steam and air supply is most vital. A coal with low fusion point of ash will give clinkers and obstruct the passage of air through the fuel bed. The B. T. U. content of a producer gas being only about 140, it is necessary to use preheated air as is the case in the Schmatolla kiln.

For powdered coal firing it is imperative that a high volatile coal be burned. This is due to the fact that ignition of the coal must be accomplished easily and that the flame must be kept intact throughout the kiln. Another vital feature in burning powdered coal is the velocity at which the coal and air stream travel. As in cement practice this is the ideal manner in which to burn lime, considered solely from the standpoint of the combustion engineer. Economic conditions and the contamination of the lime have unfortunately in many cases, a greater bearing than is exercised by fuel considerations.

In going over a list of six analyses of coal, all used in burning lime, one notices that the upper and lower limits are as follows:

Carbon	78.3	to	70.2
Hydrogen	5.5	to	4.8
Nitrogen	1.9	to	1.2
Oxygen	11.5	to	7.5
Sulphur	1.6	to	8.5
Ash	15.00	to	5.5

The oxygen and ash show the greatest variation, and in both the lower limits indicate the better fuel. Nitrogen in a coal exerts no influence other than to dilate the gases.

The question of moisture has not as yet been considered. From a combustion standpoint water is undesirable as it has a high specific heat and requires a considerable amount of heat to raise its temperature to that of the other gases. As a constituent of the gases in a lime kiln it serves a useful purpose in counteracting the pressure of the CO_2 gas liberated from the stone. Moisture then in the vertical kiln cannot be considered as detrimental.

In any investigation which has for its object the selection of the proper coal to be burned in a kiln, the factors to be considered are, like many fuel problems, of a variable nature. They depend very greatly on local conditions and on the location of the plant.

Economic conditions in most cases govern the selection of the fuel. The factors enumerated above are those that are most important in the choice of a coal for whatever purpose where quality of product is important. The best and most ideal coal may be too expensive or the cost of haulage may be prohibitive. Other items which influence a decision will be the quality of product, the nature of the limestone and the competition in the territory in which the plant is located. A "hard and fast" specification cannot be written any more than can one specification apply to the lime industry as a whole. The desirable features in a coal are:

1—Reasonably low ash content.
2—Low sulphur content.
3—Ash having a low fusing point.
4—Volatile content 30 per cent or over, especially when coal is burned powdered or in a gas producer.
5—Moisture content low if coal is burned in gas producer or powdered.
6—Moisture content fairly high if coal is burned in vertical kiln.
7—"Slack" coal is low in price but runs high in ash and sulphur.

Coals vary in moisture content from the anthracites to the peats. The latter contain a maximum content. Lignites can be burned in the pulverized form very successfully.

National Lime Association Convention Program

Seventh Annual Convention, Briarcliff Lodge at Briarcliff Manor, N. Y. May 26, 27, 28, 29, 1925.

Tuesday, May 26, 1925.

A. M.

10:00 Meeting of Board of Directors.

11:30 Executive Session of Membership.
Association Affairs.
Appointment of Committees.

P. M.

1:30 Luncheon and Address—"Lime in Dirt Roads," Dean E. J. McCaustland, University of Missouri.

2:30 Preliminaries—Golf Tourney.

8:00 Second Annual Research Conference. (A Round Table meeting of lime techinal men, plant chemists, superintendents and manufacturers.)

Wednesday, May 27, 1925.

Open Session.

A. M.

10:00 Opening Address.
George B. Wood, Pres., N. L. A.

10:15 Report of the General Manager, Burton A. Ford, Gen. Mgr., N. L. A.

10:30 Address, "Developments in the Lime Treatment of Trade Wastes".
E. B. Besselievre, Sanitary Engineer, The Dorr Company, New York City.

Executive Session.

11:00 Status of Lime Plaster Investigation.
G. J. Fink, Chem. Director, N. L. A.
J. E. Underwood, Asst. Chem. Director, N. L. A.

11:30 Report of Plaster Committee.
George B. Wood, Chairman.

12:00 Status of Lime Building Block Investigation.
J. W. Stockett, Asst. Chem. Eng., N. L. A.

12:15 Report of Lime Block Committee.
Charles Warner, Chairman.

P. M.

1:00 Luncheon and Address, "Association Literature," Miss E. H. Roth, Sheboygan Lime Works, Sheboygan, Wis.

2:00 Continuation, Golf Tourney.
Preliminaries, Tennis Tourney.
Preliminaries, Quoit Tourney.

8:30 Auction Bridge Party.
Swimming Party.

Thursday, May 28, 1925.

Open Session.

A. M.

10:00 Report of Chemical Activities.
G. J. Fink, Chem. Director, N. L. A.

10:15 Address, "Kiln Performance".
Victor J. Azbe, Combustion Engineer, St. Louis, Mo.

Executive Session.

11:15 Reports of Committees and action by Membership.

P. M.

12:30 Luncheon and Remarks.
Chas. M. Cadman, President, Pacific Lime & Plaster Company, San Francisco, Calif.

1:30 Finals, Golf Tourney.
Finals, Tennis Tourney.
Finals, Quoit Tourney

4:00 Baseball Game.

7:30 Dinner and Entertainment.
Awarding of Prizes.
(The Valve Bag Company of America will be host.)

Friday, May 29, 1925.

Open Session.

A. M.

10:00 Report of Agricultural Activities.
R. C. Towles, Soil Technologist, N. L. A.

11:15 Reports of Committees and tivities.
R. P. Brown, Construction Engineer, N. L. A.

10:30 Address, "Advantages of Lime in Water Purification and Softening," (Illustrated and Demonstrated.)
C. P. Hoover, Chemist, Water Purification Plant, Columbus, Ohio.

10:50 Address, "Lime in Asphalt".
Prevost Hubbard, Chemical Engineer, The Asphalt Ass'n.

11:15 Address.
Henry M. Camp, Eastern Division Manager, N. L. A.

11:30 Address.
G. B. Arthur, Central Division Manager, N. L. A.

P. M.

12:00 Meeting New Board of Directors.

ADJOURNMENT

Whiterock Quarries Enlarges Plant to Produce All Forms of Lime

Hydrating, Ground and Pebble Lime Plants Recently Completed Other Additions and Improvements Increase Daily Capacity

WHITEROCK QUARRIES was incorporated in 1905 under the laws of Pennsylvania and reorganized in 1913 with an increased capitalization and a very much enlarged plant and organization. Until this year, however, this company produced only one form of lime, namely, high calcium lump lime for all manufacturing, building and agricultural purposes. A new Kritzer hydrating plant, a ground lime and a pebble lime plant have recently been completed, and the Whiterock Quarries are now in a position to supply all grades of lime for almost any purpose. Additions and improvements have also been made recently in the crushing plant, making it possible to produce thirty carloads of limestone daily. Most of this limestone is sold for blast furnace purposes. There is also a good volume of business in open hearth stone, commercial size stone and highway stone.

The quarries have a wide reputation for the quality of stone. Ingersoll Rand and Sullivan air drills are used in the quarry operations. There are twelve of these drills in use at the present time. Air is supplied by Ingersoll Rand air compressors. The bench method of quarrying is standard practice. All stone is loaded by hand into Koppel and Lakewood all steel rocker type quarry cars of 2 and 2½ yard capacity. There are about 235 of these cars in use at the present time. There are about nine miles of railroad track on the property. This track includes narrow and standard gauge. On the standard gauge track 80 and 100 pound steel rails are used, while 40 and 70 pound rails are used on the narrow gauge track. The longest haul from the quarries to the mill is 1½ miles. Twenty ton Baldwin locomotives were used for this haul, but on April 23rd all of these locomotives were destroyed by fire. Operations were carried on immediately after the fire by putting a Brookville locomotive to work hauling the stone to the mill. Two shifts were worked, each of ten hours. Twelve kilns were kept in operation and from two to five cars of stone shipped daily. This Brookville had previously been used in the quarries to replace several mules.

The crushing plant consists of Allis Chalmers gyratory crushers and

View of the No. 6 Quarry of the Whiterock Quarries.

Showing View of Kilns and Crushing Plant.

screens. A Chandler and Taylor steam engine furnishes the power for the crushing plant and the Ingersoll Rand compressors. Erie boilers are used in the power house to generate steam. There are eighteen kilns of the vertical type 5½ by 30 feet in the plant. These kilns produce on an average eight tons of lime each daily. The Whiterock Quarries are carrying on extensive experiments, and they hope soon to improve their present kilns. Coal and wood are used for burning. The new Kritzer hydrating

Showing Part of Exterior of New Hydrating Plant and Top of One of Old Kilns.

Partial View of Hydrating Plant, Kilns and Lime Sheds.

Top View Shows Machine and Car Repair Shop. Middle View Shows Storage Pile for Kiln Stone. Bottom View Shows Type of Powder House Used.

A Distant View of the Mill

plant, the ground lime plant and the pebble lime plant are electrically equipped. Power is purchased from a local power company. The machine shop and the car repair shop are equipped with modern machinery and appliances. All repair work is done at the plant. Four trucks are used in the plant for miscellaneous hauling problems. The lump and pebble lime is shipped in Pittsburgh steel drums. This lime is also shipped in bulk. Prices to the consumer are quoted in bulk in steel barrels, in Calsax bags and in 50-pound bags. Pebble lime is also shipped in Calsax water proof bags. The hydrated lime is packed by a Bates packer and shipped in Bates bags. Some very attractive literature is distributed by the company.

A new water line is being now laid solely for fire protection. Fire hydrants as specified by the Underwriters Association are also being installed. The water supply comes from the Pleasant Gap Water Supply Company. Another change being effected is the addition of Plymouth gasoline locomotives of the 8-ton size. The total operating force is about 250 men. This number is largely due to the fact that the stone in this quarry is loaded by hand.

The officers of the Whiterock Quarries are: W. Fred Reynolds, President; A. Fauble, Vice-President; Ray C. Noll, Treasurer; and L. A. Schaeffer, Secretary. Ray C. Noll is also General Manager of the Company.

New Incorporations

Carrcroft Development Company, Capital, $100,000, to manufacture and deal in cement, lime and plaster. Incorporators: Franklin L. Mettler, M. E. Mettler, P. M. Gilkey, Wilmington, Delaware.

Ace Cement Construction Company, 112 North LaSalle Street, Chicago. Capital, $2,500; to carry on all or any of the business of manufacturers of or workers in cement, concrete and all kindred substances and to contract for and erect buildings, etc. Incorporaters: B. Straus, Sidney Sachel and Joseph Richner.

Rochester Granite Company, Rochester, New York. Capital stock, 1,000 shares connon, no par value. Incorporators: R. A. Fletcher, V. A. Vincelli, W. C. O'Brien.
Twohy, treasurer, all of Norfolk.

Aldercreek Cement Products Corporation, Forest Port, New York, has changed its name to Summit Duntile Corporation of Boonville.

Kaw River Sand Company, Kansas City, Missouri. Capital $10,000; to dredge, buy and sell sand and gravel and to manufacture and sell cement products. Incorporators: William J. Stewart, Fred M. Colburn, Frank M. Henry.

Lannon Sand and Stone Company, Milwaukee. Capital, $25,000; 250 shares par value $100. Incorporators: Frank Schneider, Henry M. Nugent and S. S. Thompson.

Meriwether Sand and Gravel Company, Incorporated, Shreveport, Louisiana. Capital $50,000.

Quarry Views of Whiterock Quarries.

Two Top Views Showing Lay of Ground and Waste Dump. Bottom View Shows One Section of Lime Sheds.

They chose the easy way

When the Sterrett Sand and Gravel Company needed a crusher, a screen, and a sand pump they took the easy way to get the information on this equipment—they looked in the HAND BOOK. In a recent letter they said:

> "We certainly do use the HAND BOOK when contemplating buying machinery and have purchased equipment from the following firms, that were brought to our attention by the HAND BOOK:"

You, too, can make the job of answering questions on equipment, operating data, etc., easy by referring to the HAND BOOK. It contains a wealth of material, well indexed for ready reference.

Pit and Quarry

HAND BOOK

RAND-McNALLY BLDG., CHICAGO

Plymouth 7-ton Gasoline Locomotive at Sand and Gravel it of Con

Plymouth Servic F

When you buy a piece of machinery requiring the expenditure of a considerable sum, you naturally want to know whether or not the manufacturer is interested only in the sale, or the sale and the service.

When you buy a PLYMOUTH Gasoline Locomotive you may be assured that our solicitude does not stop with the sale. It goes out onto the job. If need be, a personal service will be rendered. And the service does not stop until you are pleased and satisfied.

Not only in the field, but in the shop, service comes first. Standardization enables us to ship Repair Parts the same day the

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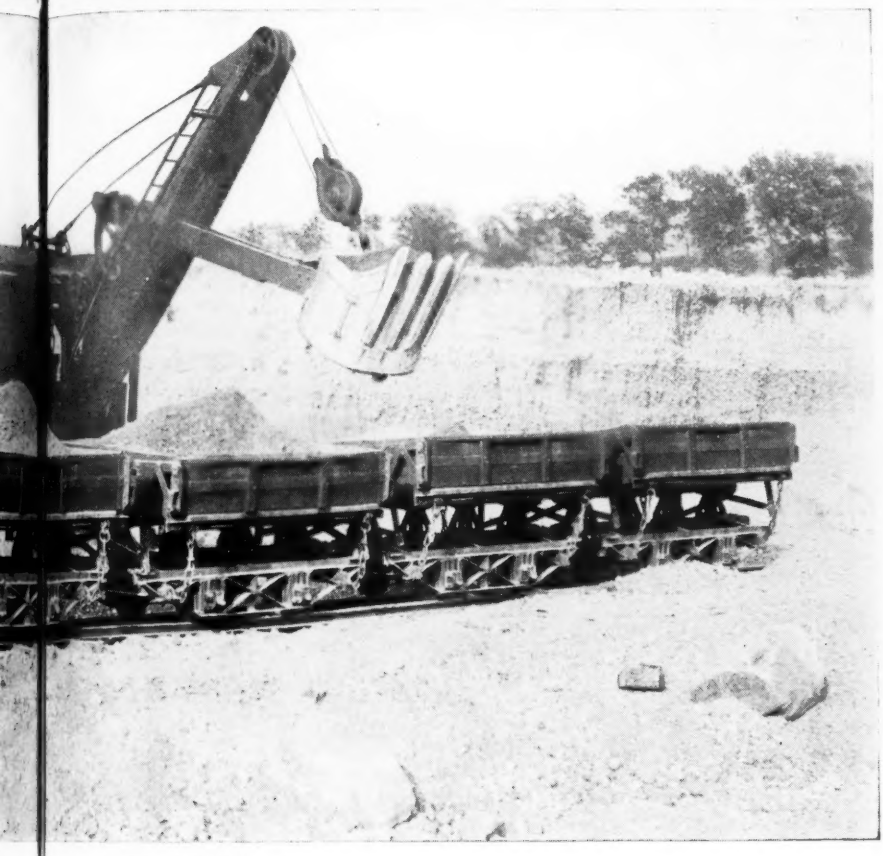

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ce Follows the Sale

order is received—**and you get the correct part, absolutely interchangeable.**

When you buy an industrial locomotive look beyond the price—ask the users about the service. We are perfectly willing to abide by the results.

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Plymouth Locomotive Works

PLYMOUTH, OHIO

MOUTH Locomotives

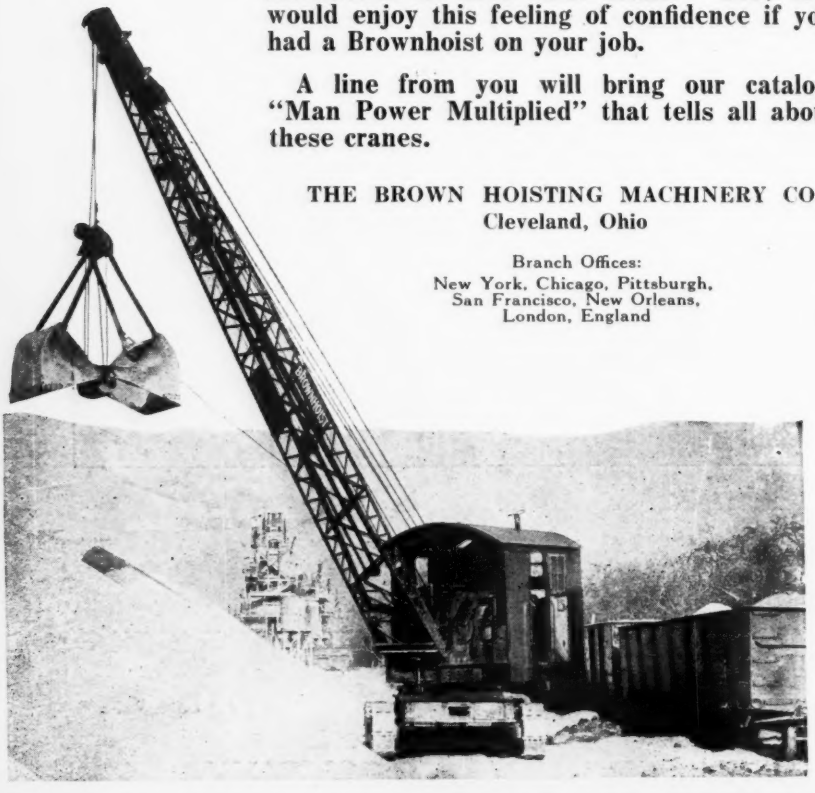
"We are indeed highly pleased—

with its operation and don't think anyone can make a mistake in purchasing a crane of this kind." That is what a large southern construction company wrote us about their No. 2 creeper crane.

"The reason we purchased a Brownhoist after quite a bit of investigation is that we consider it the best built machine on the market and the price is in line with machines of its class."

This company has recently purchased a second Brownhoist, thereby emphasizing the satisfaction of their first crane. You, too, would enjoy this feeling of confidence if you had a Brownhoist on your job.

A line from you will bring our catalog, "Man Power Multiplied" that tells all about these cranes.



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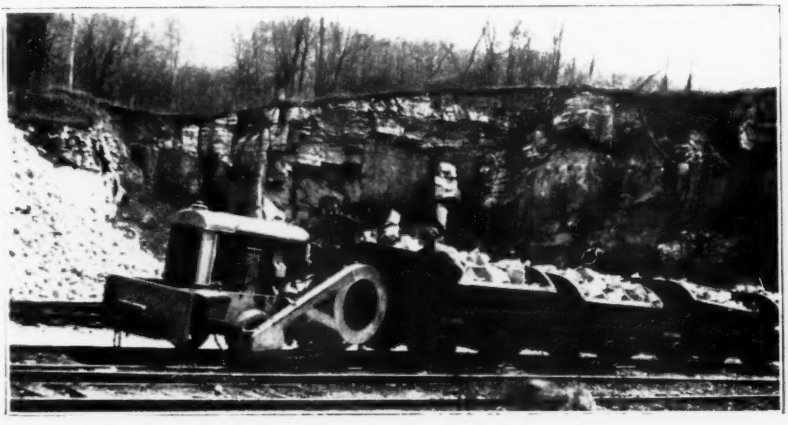
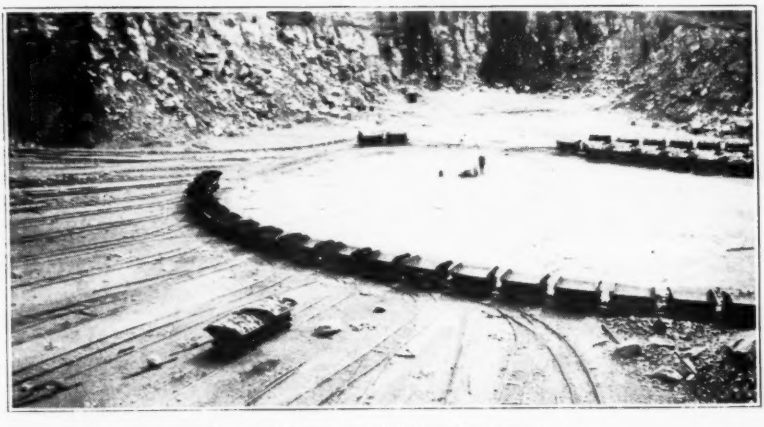
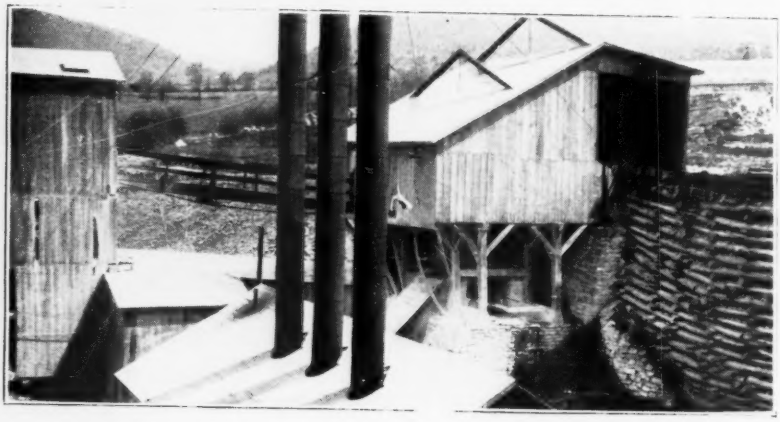




Quarry Views of Whiterock Quarries.



Plant Views of Whiterock Quarries.

Modern Material Handling Methods In the Cement Industry

Written Expressly for PIT AND QUARRY by C. H. Sonntag*

Part II

In Part I of this article which appeared in the May 1st number of Pit and Quarry Mr. Sonntag discussed material handling from the deposit to the crusher; from the crusher to the mill by belt conveyors, surface cars, aerial tramways, etc.; in dry process mills in grinding and kiln feeding; and in wet process mills by centrifugal pumps, plunger pumps, compressed air and bucket elevators. Kiln feeding in wet process mills is discussed in this section of the article and then clinker handling, bagging, coal handling and other more general material handling methods.

Editor.

THERE has been room for the exercise of considerable ingenuity in devising feeders for wet process kilns. The simplest is a plain pipe nozzle with a plug cock and an attendant to see that the stream of slurry is kept as uniform as may be. One man can watch the feeds of a number of kilns in this way, and if he is attentive to his work, surprisingly good results may be had. But of course if one is trying to increase kiln feeds by say 5 per cent, hand control does not permit this to be done with any degree of accuracy, and resort must be had to one of the mechanical devices that have been used for this purpose. Of these the two best known are the spiral and the Ferris wheel types.

The former is an adaptation of an arrangement that was originally used as a feeder for wet ball and tube mills in ore-dressing. It consists of an open-mouthed pipe bent into the form of a spiral, the inner end opening into a hollow bearing or trunnion, the whole revolving on a horizontal shaft. The outer open end of the spiral dips into a trough of slurry at each revolution, and scoops up a definite quantity which is discharged through the hollow trunnion and into the kiln feed pipe. The rate of feeding may be changed by varying the speed of the spiral or by altering the depth to which the open end dips. The latter will usually be more convenient.

The Ferris wheel feeder consists of a disc revolving in a vertical plane, to the face of which near the edge are attached a number of cups. Elevator buckets will do very well. The lower part of the disc with the attached cups is immersed in a trough of slurry. As the disc revolves, the full cups are inverted near the top, and pour their contents into a suitably disposed hopper from which the slurry flows to the kiln. The idea is very old, being based on the noria, a device used in Syria, Palestine and other Eastern countries for raising irrigation water. The feed rate may be varied by changing the speed of the disc, by increasing or decreasing the number of cups on the disc, or by altering the angle of attachment of the cups so that they may carry less than their maximum capacity.

In practice, with either of the mechanical feeders just described, it is necessary to supply slurry to the trough faster than the feeder takes it out. The excess runs back to a sump through a constant level overflow pipe, and is pumped over again. It is generally desirable that the speed of the feeder should bear some fixed ratio to that of the kiln. This may be done by driving the feeder from some part of the kiln gear train. As the feeder takes only a small amount of power, this is not difficult to do.

Clinker from Kilns

If the clinker falls from the kilns direct into rotary coolers, the operator is not confronted with the problem of handling it while it is red hot. After it is cooled the drag chain will convey it very nicely in case the mill lay-out permits the use of this particular type. However it is the general, though by no means universal, custom to store clinker for some days before grinding it, and as the drag chain will not elevate, clinker may be taken from the coolers or direct from the kilns by means of specially equipped elevators or a pivoted bucket conveyor.

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Clinker Elevators

The abrasiveness of fresh clinker, either hot or cold, is very great, and the only material that will stand up against it when made into chain and sprockets is manganese steel. If elevators are used, they should therefore be made of this alloy. The chain should be of the closed end or pintle type, to keep clinker dust out of the joints as much as possible, and the buckets should be of malleable iron. When handling hot clinker they will eventually crack along the bottom, but their life will be about a year, and no other bucket has been developed that will do the work at the same cost per barrel.

There is one serious objection to the elevator when used to take direct from the kilns. In order to get gravity flow from kiln to elevator the foot of the latter must usually be located in a pit. The time will come when some stoppage of the elevator will permit the foot sprockets and a few feet of chain to be buried in red hot clinkers, and their temperature will be raised to the point where the manganese steel will revert to the brittle condition. Safety from chain breakages will call for the removal of the overheated part, and eventually of the foot sprockets also, as the rims and spokes will ultimately crack.

Digging out an elevator that has been choked by hot clinker is a man-killing and time-consuming job. The loss of time is the most costly thing about a hot clinker elevator, as it directly affects production. If a record of the cost of shut-downs is kept, it will be found that replacing an elevator of this kind by a less troublesome device is well warranted, even when considerable investment is necessary. This does not apply to the use of elevators after clinker coolers, as here they may give excellent service.

Pivoted Bucket Conveyors

The pivoted bucket conveyor has been used to handle hot clinker for a good many years, but until comparatively recently has always been considered a hard piece of equipment to keep in running order. We now know that the fault can be about equally divided between the conveyor manufacturer and the plant designer. The manufacturer in some cases made the chain of malleable iron, and experience has shown that in a conveyor of this type, where abrasion is negligible but where stresses may become very high, the use of castings in tension is unwise. These parts should be made of bar steel, which will give a far higher factor of safety.

In some of the older installations the pit in which the conveyor ran under the kilns was not much larger than needed to accommodate the conveyor itself. In case of trouble in this pit it was almost impossible for men to stay in it long enough to do any effective repair work. We now know that we must provide ample room around the conveyor, even at considerable expense for excavation and concrete.

If the buckets are entirely of malleable iron the constant exposure to a red heat will in time warp and crack them so that they must be discarded. One company has gotten around this by designing a composite bucket, made up of malleable iron ends and a sheet steel middle part attached to the ends by only a few rivets. This steel part will not become distorted as quickly as the all-malleable bucket, probably because it is comparatively free to expand and contract, but when necessary it can be replaced at very slight expense. The ends last much longer than the whole cast bucket.

Trouble with a pivoted bucket clinker carrier means a shut-down of all the kilns until it is repaired. Consequently preparation for repairs and quick action when necessary are more vitally important here than anywhere else in the mill. A regular schedule for overhauling the chain and buckets should be followed. A proper length, say 20 feet, of chain and buckets should be in the pit, all assembled and ready to set into place. The writer has seen a hot conveyor stopped, a 20 foot section disconnected and set off the track, a new section set in place, connected up and the conveyor started again in fifteen minutes. The men were trained to do this, but it paid in the saving of time, which means barrels. If a pivoted bucket conveyor is renewed a section at a time in this way, it can always be kept in good operating condition.

Clinker Storage

As previously stated, many mills prefer to age their clinker for some

little time before grinding it. The practice serves to smooth out the inevitable variations in manufacture, and the storage acts as an equilizer between the kiln and clinker grinding departments. The handling device in the storage may consist of a properly arranged extension of the same pivoted bucket conveyor that runs under the kilns, a pillar or hammer-head crane, a traveling bridge crane or a locomotive crane.

The pivoted bucket conveyor may be so installed as to take clinker from the kilns directly to the finishing mill, and to supplement this with a supply drawn from storage in case the kilns are not furnishing all the feed wanted for the mills, or it may dump a part or all of the kiln output into storage and reclaim it later. One objection to this arrangement is that much of the clinker put into storage will not return to the conveyor by gravity, and if it is desired to use up all clinker, some additional means of withdrawing it must be used. The same objection arises in the case of stationary cranes, for when the storage is full, some of the clinker will roll beyond the reach of the bucket. A retaining wall will prevent this, but it adds to the investment and fixed charges.

The bridge crane and the locomotive crane will not be taken up here as they will be discussed fully later.

The writer has occasionally seen clinker handled from coolers or storage on a belt conveyor, but the only case with which he had personal experience was anything but satisfactory. Every kiln will occasionally turn out large balls of clinker, and the interior of these cools quite slowly. They will sometimes be red hot inside after going through a cooler. Such hot pieces are certain to get into the belt sooner or later and seriously damage it. The effect on maintenance cost is self-evident.

Clinker Grinding Department

If a special reclaiming conveyor is to be provided under the clinker storage, the drag chain is probably the best device available at this time. Clinker may be fed to it uniformly by reciprocating feeders, which may be used to add the gypsum also if bulk measurement of this ingredient is satisfactory. If it is not, special weigh hoppers for clinker and gypsum must be provided.

In the past, because nothing better was to be had, a great deal of coarse clinker was handled by screw conveyors. The well-known abrasiveness of clinker makes the wear and tear on such a conveyor out of all reason, and now-a-days only exceptional circumstances would warrant such an application. The drag chain may be used as a distributor over the mill bins, so that the screw conveyor can be entirely eliminated until after grinding.

If two stage reduction is practiced two spiral conveyors and an elevator will ordinarily be needed between the preliminary and finishing mills. If grinding is done in one stage these are of course not required, and screw conveyors and elevators are the usual equipment for transportation to the stock-house.

Belt Conveyors

Cement is sometimes discharged directly onto a belt conveyor, either rubber or canvas, and the same type of conveyor is used in the overhead bridge to the stock-house. There is one serious objection to this practice. Cement leaves the mills at a temperature usually above that of boiling water. Thermometer readings above 240 degrees Fahrenheit have repeatedly been noted, and this is doubtless not the maximum. At this temperature rubber is slowly but surely over-vulcanized, the surface of the belt finally becoming hard and horny, and broken up by numerous transverse cracks. If a canvas belt is used the oils with which it is impregnated become oxidized to the point where they are of the nature of dried varnish, and the surface of the belt cracks. If a 4 ply belt is used, the hardening action goes clear through and the belt soon becomes worthless. In case of a 6 or 8 ply belt the hardening will usually include the first four plies, leaving the others to hold the belt together. The extra cost of the thicker belt is more than repaid in the greater service obtained, for the real cost of a conveyor is not its purchase price but the cost per barrel of cement handled.

Stock-House and Packing

There are bins still in use from which the cement is removed by hand scrapers into a screw conveyor under the floor along the front of the bins. Fortunately they are being rapidly

replaced by more modern equipment, for the work of pulling bins by hand is costly, dusty and dangerous. An improvement on this is the application of power scrapers similar to those used in cleaning out grain cars. The old bins can be kept in service and a higher output per man may be had, but the dust is still a nuisance and there is more or less danger of slides.

The first introduction of the Bates packer, whose use is now almost universal, was in the form of a portable machine that was taken into the bin and kept against the bank of cement, which was scraped to it by hand. This did away with any other conveying system, but dust and the danger of slides were still present, and it was sometimes necessary to truck the sacked cement up-grade to the cars.

The modern silo storage made up of tall circular bins has changed all this. These bins are permanent, as compared to the old wooden structures that were occasionally set on fire by the hot cement and were frequently forced out of shape by the stresses of filling and emptying. Concrete construction permits a spacious basement to be built under the silos, in which there is ample room for the reclaiming machinery. This commonly takes the form of a number of double flighted feeder conveyors, under each silo, discharging into one or more longitudinal screw conveyors that carry the cement to the packing department. This latter is generally in a separate structure containing also the bag sorting, cleaning and repairing machinery and storage. There is nothing special about the conveyors and elevators handling the cement except that it will pay to make them larger and heavier than once was considered good enough.

In older packing houses the sacked cement is trucked from the machines into the cars. The modern idea is to drop the filled bags from the packer onto a belt conveyor which will carry the output of two or more machines to the door of the car, so that trucking is reduced to that in the car itself.

The writer believes that in the interest of economy some machine will develop that will put the filled bags into the car without hand trucking, as the work is dirty and laborious, and in hot weather men to do it are sometimes hard to get. Uniform piling of the bags by hand helps to check the count, and is the easiest way when using trucks, but it is not absolutely necessary, at least in cars loaded to only 60,000 or 80,000 pounds.

Bag Handling

As long as the cement industry tolerates the returnable package, so long will we have the care of dirty bags. In modern plants the bundles as received from the customers are taken at once to the top floor of a three or four story building by means of an ordinary platform freight elevator. Here they are counted and sorted. If a number of counters are needed, time and labor can be saved by having them push the bags, after they are through with them, onto a wide, very slow-moving belt conveyor which dumps them into the cleaning wheel. Worthless bags and those that need repairing are piled up until a sufficient number is collected to put through the wheel in one lot. This wheel is so large that its discharge is on the floor below, where the bags drop onto another slow-moving belt conveyor. Men along both sides pick off the bags and stack them ready for the tyers. These belts should be about 30 inches wide, and may be only four ply, as the service is very light. The upper run should slide on hard-wood boards instead of running on the customary rollers, in order to give a level and uniform working surface. The dust from the cleaning wheel and the spill from the packing machines are collected by ordinary screw conveyors and returned to the bins over the packers. As these conveyors handle only light loads, the 12-inch size is usually large enough, and 15 or 20 revolutions per minutes will suffice.

Coal Mill

Assurance of continuous operation demands that a good reserve supply of coal be kept on hand. If it is certain that it will always be received in hopper-bottom cars, these may be dumped into a track hopper and elevated onto a conical pile by an ordinary long pitch slow speed inclined bucket elevator. Usually one must take coal in whatever kind of cars is offered, and some of the mid-west railroads are converting their drop-

bottom cars to solid bottom gondolas. Any car may be emptied by dumping machines such as are used to load vessels on the Great Lakes, but such equipment is beyond the reach of the average cement mill purse. In these days hand unloading is too expensive and uncertain, and the two best devices in use for unloading solid-bottom cars are the locomotive crane and the bridge crane. Either of these will build up a storage pile and will also reclaim from it, and in large mills the installation of a bridge crane for handling coal only is probably justified.

Unless the crane discharges into an overhead hopper, the customary way of recovering coal from storage is by conveyor in a tunnel under the pile. A rubber belt will do fairly well for this, but the coal is apt to be wet, and the fines will build up on the pulley so that there is always danger that the belt will run to one side and damage itself. Here again the drag chain will give good service, as coal is so little abrasive that the chain should last almost indefinitely in it. Feeders should be provided to give the conveyor a uniform load.

In the coal mill proper the screw conveyor is in practically universal use. The power required and the abrasive wear are not great, and so far as they are concerned the conveyors and elevators need not be heavy. However, the water vapor that is continuously arising from the coal, even when it is supposed to be dry, is extremely corrosive, and hence conveyor flights, troughs, dust boxes, stacks and elevator casings should be made of heavier steel than at first would seem to be demanded. Flimsy construction in the coal mill means only a rebuilding job in the near future.

A very great advance in the art of conveying powdered coal has been made in the last two or three years in the development of the Fuller-Kinyon pump. This device permits an extension of the conveying system beyond what would have heretofore been considered wise. The pump is also coming into use in handling ground raw mix and finished cement, and possibly fine dry powders in other industries also. Being a novel invention, it seems best to treat it in some detail, which will be done in a short supplement to this paper.

In General

The two oldest material handling devices in use in cement mills are the screw conveyor and the bucket elevator, and these have been developed from the light and cheaply made ones found in the flour mills and grain elevators of half a century ago. In order to insure continuous operation one or two plants have installed much of this apparatus in duplicate, while others have doubled up on the elevators only, the reason being that it usually takes longer to repair a broken elevator than a conveyor. Most mills however have these machines put in singly, and depend on extreme ruggedness of construction to avoid break-downs. In accordance with this idea the 12 inch conveyor has largely given way to the 16 inch or larger size. This is made with the flights never less than ¼ inch thick, and usually ⅜ inch, and they are mounted on 4 or 4½ inch extra strong pipe with couplings and coupling bolts correspondingly large.

The old flour and grain elevator had the buckets attached to a rubber or canvas belt. Such elevators are still used in many rock crushers, but in cement mills proper the idea has been entirely abandoned, for the heat and moisture encountered, especially where a casting is used cause such variations in the length of the belt that it will either slip or break. They are now made with malleable or steel buckets fastened to a chain which is either of the malleable Ley bushed type or is all steel, and this chain is made considerably heavier than formerly. Manganese steel is coming into extensive use for this purpose.

The two principal causes of elevator failure are loose buckets and the working out of the joint pins. The latter means that the whole chain falls to the bottom of the casing, with a four or five hour repair job ahead. Loose buckets may be largely avoided by riveting the ends of the bolts over the nuts after the bucket is bolted on. This is an old cement mill trick, but may be new to some. The working out of joint pins is usually caused by loss of the cotter key that holds the pin in place. The writer has found these cotters rather unreliable, and has replaced them with short pieces of round soft steel rod bent in S shape. They give far longer service than the cotters. Rolled manganese steel rod has also been tried for this, but it is usually so brittle

that it will not stand the bending required.

Elevator and conveyor drives.

One can not leave this subject without mentioning the change that is taking place in the manner of driving elevators and conveyors. The use of motors is now almost universal, but the small motors used for these drives will run at 700 revolutions per minute or faster, while elevator head shafts run at about 32 RPM and conveyors at from 50 to 70 RPM. This reduction in speed is too great to make in one step, and until recently group drive from a small motor through a short countershaft was common. Speed reduction could thus be made in two stages, and two or three elevators and conveyors could be driven from one motor. The necessary belts and drive chains were prolific sources of trouble—more so than the elevators and conveyors themselves.

The development of enclosed spur and worm reducing gear units has changed all this. Each elevator and conveyor can now be driven by its own motor at its appropriate speed without regard to other machines, and these enclosed units will run continuously for long periods with no attention other than oiling. The mill can be standardized on a few types and sizes of these speed reducers and spare ones carried in stock. Then in case of failure a new one can be substituted with very little loss of time, and the old one taken to the shop and repaired at leisure and with proper facilities by skilled mechanics.

Locomotive Cranes

These machines have not been discussed in the earlier part of this article because their use around a cement plant is too universal to be considered under any one department. When fitted with a grab bucket they can unload from cars or handle in any other way rock, shale, clay, clinker, sand, coal, gypsum or any other loose bulk material and can do it at any point on the track. They can be used to erect machinery and buildings, being fitted with an extension boom for the latter purpose if necessary, as the load is usually light. They can place bulk material on a stock pile and reclaim from the same pile. If the pile is between two tracks whose distance apart is not more than twice the effective reach of the crane with loaded bucket, the entire pile may be reclaimed without extra handling. Cranes may be used to switch cars, though this is not to be recommended except in emergencies, for the propelling mechanism is not designed for continuous use in this way. When fitted with drag line buckets cranes may be used to excavate clay or dry marl, and make excellent machines for this purpose. After one has had a crane in service around his plant for some time, he wonders how he ever got along without it.

As to the size to purchase, a machine of 25 or 30 tons rating with 1½ cubic yard bucket and 50 foot boom makes a very nice unit for general use. Those of smaller size are too limited in capacity to be entirely satisfactory. Large mills will be warranted in buying a 40-ton machine with 2 cubic yard bucket. Two independent hoisting drums should always be specified, to operate a two-line bucket.

Locomotive cranes suffer under one serious handicap. In order to build machines that will be stable on standard gauge track, manufacturers have had to design them very compactly, and have had to make compromises in machinery arrangement that would not otherwise be considered. In order to get at parts near the bed-plate it is usually necessary to remove most of the upper ones, and this takes time. For this reason mill operation should be so planned that the crane can be out of service for two or three days at any time without crippling production.

For complete independence of action the steam crane is essential, and a supply of soft water for the boiler will amply repay its cost.

Bridge Cranes

These may be had in a wide variety of sizes, from the small one of 40 feet span or less to the great machines used in handling iron ore around blast furnaces and at Lake ports. Their first introduction into cement mills was to move clinker into and out of storage. Later they were used for coal, and still later for the raw materials. None but the largest mills or those that do a considerable business in commercial crushed stone are warranted in using very long span bridges, but those with spans up to 100 feet are finding quite a little application.

In considering their purchase there are several points that should be borne in mind:—

1. The runway should be high enough to permit the storage of

a large bulk of material per square foot of floor area.

2. Retaining walls under the runway are desirable. If they are not used, a certain portion of the material will roll beyond the reach of the bucket when reclaiming. This is particularly important with short span cranes.

3. The trolley should be of the over-running rather than of the suspended or telpher type.

4. The operator should have an enclosed cab.

5. As clinker dust is very abrasive, the motor and all gears should be completely enclosed, and the gears should be in cast iron cases with machined joints, tight enough to retain lubricant and keep it clean. Bearings outside the gear cases should be as dust-tight as it is possible to make them.

6. Cranes for ordinary lifts can be operated by alternating current motors with entire satisfaction, and will be so furnished by the manufacturers if so desired. For very high lifts the matter of dynamic breaking should be considered, and this can only be had in connection with direct current motors. Unless the mill already has some source of direct current it will be necessary to provide a motor-generator set for the crane.

7. Every gear on the crane should be of steel and heat treated.

In Conclusion

If any one part of a cement mill may be said to be more important than another, that part is the conveying equipment. Dryers, pulverizers, kilns and generators are usually provided in duplicate so that at least partial operation may be kept up, but in most mills the conveyors and elevators have to "go it alone", with nothing to fall back on but material stored in bins. It is not surprising then that owners have been willing to pay for heavier and still heavier and more reliable equipment of this sort, for one of the principal ways to cut down the cost per barrel is to keep production at its maximum. This means continuous running, and the savings secured thereby will justify investment in high-class machinery. It is hoped that the foregoing discussion will help in choosing material handling devices wisely.

Highway Material Specifications In Marion County, Indiana

By Geo. G. Schmidt, County Engineer, Marion County, Indiana.

CONCRETE pavements in Marion County, Indiana, have not withstood the effects of traffic and the disruption due to swelling and heaving of the foundation when saturated with water because of an inferior quality of concrete. Specifications have no doubt been followed during construction and contractors and inspectors have made an honest effort to secure good workmanship. The paved roads in Marion County, Indiana, are equal or superior to those in adjoining counties where similar materials were used. The fault does not lie with the public officials or the builders of the road, who in most cases used the best of the available local materials in the proportions and to the thickness specified.

When, in making a concrete mixture, hard, clean pebbles or broken stone are used as a coarse aggregate, the concrete thoroughly mixed and the specified amount of cement and water added, the strength of the resultant concrete will depend on the mortar matrix which fills the voids in the coarse aggregate. For this reason two parts of sand are specified to three or more parts of pebbles or broken stone. It has been demonstrated both by laboratory tests and in thousands of miles of roads constructed that a mortar leaner than that secured with two parts of sand to one part of cement does not have the cementing strength to bond the pebbles together nor the toughness to resist wear under traffic.

Much of the gravel furnished locally has more than five per cent of sand contained in the gravel; some of it has been found to contain as much as thirty per cent of material passing a one-quarter inch sieve. When gravel with this amount of sand is used, mixed with the specified amount of sand, cement and water, the concrete necessarily has a mortar leaner than is required for the strength desired.

There has recently been a great deal of discussion of and some argument over the comparative value of gravel and crushed stone as coarse aggregate for concrete. The re-

sults of experiments conducted by the Bureau of Public Roads of the U. S. Department of Agriculture on a test road built with many different types of materials have been cited by both sides in the controversy. Following are some of the conclusions that were drawn from the results obtained in those tests:

"That the rate of wear of stone concrete is, in general, not affected by the coarse aggregate, provided the coarse aggregate is equal or superior to the mortar matrix in resistance to wear."

"That gravel concrete, in general, is at least as satisfactory from the standpoint of wear as stone aggregate."

The object of the test was to determine the surface behavior of the roads with various types of materials used as aggregate. In all cases the test sections were built of concrete proportioned one part cement to one and one-half part sand and three parts coarse aggregate, the coarse aggregate being graded down to one-quarter inch in size.

These test road findings concerning the value of gravel aggregates will only apply in Marion County, Indiana, if the material smaller than one-quarter inch is removed from the gravel, as was done in the Bureau of Public Roads Tests. Much of the gravel furnished locally for concrete purposes contains fifteen per cent or more of material passing a quarter inch sieve. It is the contention of the writer that if the gravel as furnished contains such fine material and then the specified amount of sand and cement is added the resulting concrete has a mortar matrix of insufficient strength to properly bind the pebbles together or to resist wear under traffic. This is in line with the findings of the Bureau of Public Roads, and the condition of many local concrete roads which have worn unevenly and developed breaks and holes.

The present Marion County road specifications stipulate that the coarse aggregate shall be crushed stone or gravel, and, regardless of which is used, not more than thirty per cent of the material shall pass a screen having one-half inch openings and not over five per cent shall pass a quarter inch opening. This is the specification being used by the Illinois Highway Department and which Mr. H. F. Clemmer, Engineer of Materials, says was adopted after conducting an extensive investigation in which hundreds of concrete specimens were made. Mr. Clemmer also says, "In our investigation we found that the amount of fine material passing the one-half inch sieve must be controlled. An excess of fine material passing the one-half inch sieve will reduce the strength of the concrete." That this grading requirement does not bar the gravel producers from selling their product is proven by the fact that many plants in Western Indiana are shipping gravel to Illinois for use under these specifications.

There is no doubt in my mind that most of the failures in concrete roads in Marion County are due to the poor grading of the aggregate and for this reason I feel justified in taking every precaution against failure by specifying a properly graded material. I intend to insist that all material furnished as coarse aggregate, whether gravel or broken stone, shall contain not to exceed five per cent of material passing a quarter inch screen. There is no advantage gained by using clean material or hard material and then ruining the road by attempting to bind these ideal materials together with a mortar too weak to hold them in place.

Hill Collar Oil Bearing

A new bulletin issued by The Hill Clutch Machine and Foundry Company of Cleveland, formerly The Hill Clutch Company—Bulletin Number 112—describes the Hill collar oiling bearing and other products of this company.

In the Hill collar oiling bearing the positive oil feed and distributing system immediately starts a forced oil circulation. A heavy unbroken oil film is maintained which lifts the shaft free, from all metal contact which greatly reduces the wear, and being a truly film-borne bearing the efficiency they say, is extremely high. Exceptionally heavy pressure can be carried. The bearings require only occasional attention, when fresh oil should be added.

A Way to Save Money in Lime Manufacture

Written Expressly for PIT AND QUARRY by R. N. Van Winkle*

Commencing with the June first number, Pit and Quarry will publish a series of articles entitled "Blasting Practice in Quarry and Open Pit Mining." This series of articles has been prepared by Mr. R. N. Van Winkle who from experience as a quarry and open pit mine operator and as a consulting engineer has been able to present a most comprehensive treatment on blasting practice.

There is a need for data covering blasting and explosive handling as applied to quarry and open pit mining. The industry will welcome these articles which will start with the June first number of Pit and Quarry and appear in each succeeding issue until the series of six articles has appeared.—Editor.

R. N. Van Winkle.

THERE is little question that practically every lime manufacturer is more or less interested in labor saving devices. Furthermore he knows, if he is a good operator, why and where practically every dollar of pay roll is spent, and sometimes the average operator in his anxiety to restrict overtime and cut down pay roll costs, loses sight of other ways and means of eliminating expense or saving money.

The quarry out of which comes the raw material for the production of all lime is in reality the fountain head of the lime manufacturing business. Without a quarry which can produce a constant supply of suitable and properly sized raw material there unquestionably would be no reason for the construction of a lime plant or the entering into the lime manufacturing business. While it would appear that the quarry and quarrying operations are the fundamental and basic operation of lime manufacturing, too often proper attention is not paid to this phase of the industry and quite often the dog, which is the quarry, is wagged by the tail, which is the kilns and lime plant proper.

The amount of money or the cost of production of stone for lime plant use in reality is not as important as the money spent or the cost of producing stone in a quarry which is operated purely for the production of commercial crushed stone. The cost of producing a ton of stone for lime burning is in reality a small item when compared with the selling price of a ton of manufactured lime, and a cost incidental, it might be termed, to lime manufacturing; while the quarry engaged in the production of commercial crushed stone only looks entirely to the difference between the production cost and the selling cost of a ton of stone as their profit. Therefore, as more attention is paid as a usual thing to the method of attack and practices to be followed in quarries producing solely crushed stone for commercial purposes, many things can be learned by the lime manufacturer regarding quarry operations from the operator that is producing solely crushed stone.

The principles of operation in the two quarries, while varying in some minor details, are essentially the same. As explosive or blasting costs are conceded to be the second biggest item of expense in the quarry operation where stone is produced for commercial uses only, it is fair

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and right to assume that it is the second greatest quarry expense in quarries producing stone for lime manufacture. In commercial crushed stone quarry operations approximately 30 per cent of explosives is wasted. There may be exceptions and doubtless there are, but on the whole in the class of quarry operation it will not be an exaggerated estimate. This same condition exists in the majority of quarries producing stone for lime-burning purposes. Approximately 30 cents of every dollar could be saved that is now being spent for explosives and explosive accessories if lime manufacturers would give adequate attention and study to this phase of quarrying. Practically every lime manufacturer is highly interested in every dollar lost in paying an employee for time he did not work, and well he may be if he expects to make his business successful. These same men, however, are too often forgetful of the many dollars lost in operating efficiency owing primarily to the fact that they are less tangible. For instance an error made in time keeping where a worker is overpaid a few cents or maybe a dollar, if discovered, is a grave mistake, but the wasting of dollars in blasting operations is quite often overlooked or considered unavoidable.

Aside from this waste of explosives it appears that there are other ways of saving money in explosive costs where quarrying is carried on as a means of producing stone for lime making. Unless rotary kilns are used, the producing of stone for lime burning is very similar to the producing of stone for use at blast furnaces as flux. In both instances a uniform and large sized stone is required, that is to say, the elimination of small sized material or fines is necessary and important. While it may appear offhand that explosives have little or no bearing upon this question, in reality they do have more than would be imagined. The percentage of fines or small material under ordinary conditions can be increased or decreased about 15 to 20 per cent depending on blasting operations alone. The lime operator or lime manufacturer, who has no market or means of disposing of these fines, but who must class them as a waste product or a product out of which a minor revenue is derived, should be greatly interested in this one problem. Quarries which are considered primarily fluxing stone quarries, or quarries where the bulk of the business is the making of flux stone for blast furnace use, have been confronted with this question of fines. The larger ones by a strict application and development of their shooting problems have been able to reduce in large measure the percentage of fines, which to them were almost a waste product. This can also be done in quarries producing stone for lime purposes.

A number of lime manufacturers have found that, owing to labor conditions and to the production of a more uniform sized stone for lime making purposes, surprising results may be obtained by going to the steam shovel method of loading and by having large initial crushers. By this method, however, they find on their hands quite a quantity of small sized stone, screenings and fines which they must market. By this method of operation they have been called upon to play the role of lime manufacturer and have been forced into the commercial crushed stone business in order to obtain a market for the sizes of crushed stone which they were not able to use economically in lime manufacturing. In many instances this playing a dual role has been successful. In other cases the lime manufacturer has really thrown on the market at bargain prices the smaller sized material for which he had no use. His attitude is that any price he may be able to get for this material is gain owing to the fact that he was primarily interested in producing kiln size stone for the manufacturing of lime. If playing this dual role of a lime manufacturer and a commercial crushed stone producer has worked out satisfactorily, there is no reason for a change; but if the experiment has not been successful and the lime manufacturer wishes to reduce the quantity of material which is under size for successful lime burning, he can do no better than to concentrate on his blasting or shooting problems. By proper handling he can reduce the production of fines about 15 or 20 per cent. Thus there are two methods available to lime manufacturers for saving money: first, by curtailing explosive waste; and

second, by reducing the percentage of fines and small sized stone if there is not a profitable market for them.

The elimination of waste in blasting operations offers a particularly fertile field, not alone from the manufacturer's point of view, but also from the standpoint of the consumer. While dynamite has been used in the United States for only about 60 years, the improvements made in its manufacture, distribution and use have been enormous. While the price of dynamite has increased considerably in the last 10 or 12 years, it is a fact that stone is now being moved or blasted more cheaply each year. This is not due to the fact that explosives are cheaper, for they are not, but it is because men are devoting more thought and time to the problems of scientific blasting and are making it a profession.

It is hardly to be expected that the busy lime plant or quarry operator can go deeply into the question of scientific blasting or shooting as do the men who qualify themselves for explosive engineers; hence, unless these operators of quarries and lime plants are willing and have the time to devote to real thought concerning this important and costly operation, it will be good policy for them to advise with a scientific explosive engineer regarding the blasting operations. The attitude of some quarrymen who are making a sizable blast is like that of a man who knows that he must have a tooth extracted. He does not care to know much about it but realizes that it must be pulled. He comes to the point of thinking that the more quickly it is done, the better satisfied will he be. This attitude regarding blasting operations is a grave mistake, irrespective of how small the plant may be. There is no plant or operation that is too small to profit by efficient blasting or shooting practices and principles. More economical explosives and more efficient methods of detonating are constantly being brought out by manufacturers. New and effective practices are constantly being developed by explosive engineers and by men who make this class of work their profession. The operator who is depending solely upon what some people call "the natural born shooter or powder man" is failing to appreciate the trend of explosive efficiency. Modern industry is becoming more complicated year by year. It is worth while for the lime manufacturer to give consideration to blasting and shooting problems which are a ready and easy means of saving money in the lime manufacturing industry.

In an article which appeared recently in a trade journal the following statements were made: "One peculiarity common to most powder men is that they take a wonderful satisfaction in their work. They study their material and their grade stakes as an artist does his job. Some powder men are made. Most of them just naturally know how to place a shot so it will do the best work at the least expense." This unquestionably expresses a wonderful sentiment. The writer believes, however, that blasting, to be successful, efficient and economical, the three fundamentals of all blasting operations, must be scientific and not a question of art. Records, accurate measurements of material to be shot, and a knowledge of explosives and their properties with due consideration given to the use for which the stone is to be blasted, are some of the fundamentals of scientific blasting. While any person of mature age and average intelligence can handle high explosives, the question is with what degree of safety, efficiency and economy can it be done. The information gathered by explosive engineers and explosive manufacturers is of practical value. Scientific application of such knowledge is a far better proposition from the standpoint of dollars and cents than relying on the so called natural powder man.

The Pennsylvania Pump & Compressor Company, Easton, Pennsylvania, has issued Bulletin 205 describing a close coupled centrifugal pump, suitable for brine or water service, in 1 and 1-1¼ inch sizes and for capacities from 10 to 45 GPM.

Foote Bros. Gear and Machine Company is now represented in Duluth and the surrounding territory by the Arrowhead Sales Company, 227 Wabasha Street, recently appointed IXL distributors.

Fluorspar in 1924

The shipments of fluorspar in 1924, as shown by a statement given out by the Department of Interior compiled by Hubert W. Davis, of the Geological Survey, amounted to about 124,914 short tons, valued at $2,453,950, an increase of about 3 per cent in quantity but a decrease of about 2 per cent in total value as compared with 1923. The reported average selling price f.o.b. mine shipping point decreased from $20.68 in 1923 to $19.65 in 1924. Colorado and Kentucky were the only states that recorded an increase in 1924. The shipments of fluxing grade fluorspar to steel plants and foundries showed an increase of about 11 per cent in 1924, but the shipments of the higher grades of fluorspar recorded a decrease of about 28 per cent. The stocks of fluorspar at mines or at shipping points at the end of 1924 amounted to about 69,000 short tons. These stocks consisted of about 28,900 tons of crude fluorspar (which must be milled before it can be marketed), 32,400 tons of gravel fluorspar, 6,600 tons of lump fluorspar, and 1,100 tons of ground fluorspar.

The imports of fluorspar into the United States in 1924—51,043 short tons, the largest quantity ever imported—were equivalent to about 41 per cent of the domestic shipments of fluorspar, as compared with 35 per cent in 1923. England the principal source of the imports, supplied about 49 per cent of the total. The value of the foreign fluorspar averaged $10.89 a ton in 1924. The cost to the consumers in the United States includes in addition to the duty of $5 a ton, the ocean freight charges, the cost of transporting the fluorspar from the mines to the docks, loading charges at the docks, and other small charges.

The producers of about 94 per cent of the basic open-hearth steel that was made reported that they consumed 111,419 short tons of fluorspar in 1924 and had stocks on hand amounting to 60,207 short tons on January 1, 1925. If the steel companies that did not report consumed a like proportion of fluorspar, the figures given indicate a total consumption in all steel plants of about 118,500 tons in 1924 and total stocks of about 64,000 tons on hand January 1, 1925. The total consumption of fluorspar by steel plants in 1923 was about 138,000 tons, and the total stocks on January 1, 1924, were about 49,900 tons. The consumption of fluorspar per ton of steel produced in 1924 averaged 7.8 pounds, as compared with 8.1 pounds in 1923.

New Traylor Foreign Plans

The Traylor Engineering & Manufacturing Company of Allentown, Penna., which has for a great many years specialized in the manufacture of mining, crushing and cement machinery, has made arrangements to have its products, for Europe and the Far East, manufactured by the Usines Carels Freres, Societe D'Electricite & DeMecanique, at Ghent, Belgium.

This plant is the European connection of the International General Electric Company and places at the disposal of Traylor customers one of the finest plants in Europe. This arrangement will be of material aid to Traylor's many customers in Europe, Asia and Africa, as it will bring the base of supplies very much closer and also enables customers to secure Traylor products manufactured either in Europe or America.

Carels does not need any introduction to the trade, being one of the oldest manufacturing organizations in Europe, having specialized in heavy power equipment, and being builders of the famous Carels Deisel Engines, many of which are in use in the mining centers throughout the world. The Phelps Dodge Corporation have several large units of Carels engines in their mines in Arizona and Mexico.

The experience and facilities of the Carels Company will enable them to produce Traylor equipment in the same high quality that has been established in the Allentown plant of the Traylor Company and it is believed that this arrangement will have the most enthusiastic endorsement of all of the Traylor clients throughout the world.

The sales in foreign countries of Traylor equipment has in the past been handled by the Traylor Engineering & Manufacturing Company's Foreign Sales Department, with main office at 104 Pearl Street, New York, N. Y., U. S. A. This same department will handle the output of the Carels plant in conjunction with its branch offices in London, Johannesburg, Rangoon, Lima, Santiago, Antofagasta, Buenos Aires and other large centers where branch offices and agencies will be established.

Recommended Specifications for Lime in the Manufacture of Sugar

RECOMMENDED specification for limestone, quicklime, lime powder and hydrated lime for use in the manufacture of sugar is the subject of the ninth of a series of specifications prepared by the Bureau of Standards for lime that is used in various chemical industries. To assist in the development of these specifications the Bureau of Standards has called together an Interdepartmental Conference on Chemical Lime, composed of representatives of the Geological Survey and the Bureau of Mines, of the Interior Department; the Bureau of Soils, Bureau of Chemistry, Forest Service, and Fixed Nitrogen Laboratory of the Department of Agriculture; and the Chemical Warfare Service of the War Department. The present specification, which is practically what follows, was based on a draft originally prepared by M. J. Proffit of the Bureau of Standards and has been unanimously approved by the conference mentioned, by the Hawaiian Sugar Planters Association and by the National Lime Association.

Lime is used in the sugar industry either to precipitate impurities from the juices or sirups or, in the Steffen process, to precipitate the sugar from impure solutions. For the former purpose either lump quicklime or hydrated lime may be used; for the latter purpose very finely ground quicklime, known as lime powder, is required. When the process requires the addition to the juice of an excess of lime which is afterward precipitated by carbon dioxide, the sugar manufacturer usually finds it economical to buy lime and carbon dioxide together in the form of limestone. This industry requires the purest grade of high calcium lime products which can be economically obtained. Lime powder in particular must be exceptionally pure as well as finely ground.

Limestone used in the manufacture of sugar consists essentially of calcium carbonate. The limestone is calcined to carbon dioxide and quicklime in a suitable kiln. The size of the stone depends upon the type of kiln. For a shaft kiln the stone should be uniform in size to permit uniform calcination and not too fine, lest the draft be choked. An exceptionally pure grade of stone is required if lime powder is to be made.

Quicklime as used in the sugar industry is the product resulting from the calcination of limestone and consists essentially of calcium oxide. It will slake when water is added to it, and this slaking is accompanied by an evolution of heat and an increase in volume. Quicklime can be slaked to form milk of lime, which is used to precipitate impurities from the juices, or it can be ground to form lime powder for use in the Steffen process. Pure high calcium lime is required in either case.

Lime powder is finely divided quicklime. Lime powder is added to cold diluted molasses in the Steffen process to precipitate calcium saccharate, leaving the impurities in solution. For this purpose it must be properly calcined, very fine, and exceptionally pure. Even air-slaking renders lime inactive for this purpose.

Hydrated lime is a dry powder which is made by treating quicklime with enough water to satisfy its chemical affinity under the conditions of manufacture. Hydrated lime as used in the sugar industry consists essentially of calcium hydroxide. Hydrated lime is added to the juice in the dry form, or it is mixed with thin juice or with water to make milk of lime, which is used to precipitate impurities from the juice or sirup.

Limestone can be shipped in bulk in carload lots. Quicklime can be shipped either in bulk, in carload lots or in barrels holding 180 pounds net or 280 pounds net each. Lime powder must be shipped in air-tight containers. Hydrated lime can be shipped in paper bags holding 50 pounds net each.

Each carload of material or fraction thereof must be legibly marked with the names of the consignor and consignee and with some means of identifying the particular contract on which the shipment is made.

Lime products shall meet the following requirements as to chemical

composition when the sample is taken at the point of delivery and when the results of analysis are calculated to a non-volatile basis.

sealed air-tight immediately after it is filled.

In testing, crush the sample to pass a Number 100 sieve. Put ap-

	Sugar soluble lime, minimum	Magnesium oxide, maximum	Loss on ignition, maximum
	Per cent	*Per cent*	*Per cent*
Limestone[1] for Steffen process	90	3	.....
Limestone for other purposes	85	3	.....
Quicklime for Steffen process	90	3	.....
Quicklime for other purposes	85	3	2
Lime powder	90	3	5
Hydrated lime	85	3	2

[1]Limestone is calcined before analysis (see Methods of test).

The size of limestone for shaft kilns shall be a matter of contract between the stone producer and the sugar manufacturer. A tolerance of 2 inches above or below the specified size of stone is allowable. Lime powder shall be of such size that 98 per cent of it will pass a Number 200 sieve, but not so fine that it will "ball" when rotated in a 40 mesh bolter at 20° C. Hydrated lime shall be of such size that 98 per cent of it will pass a Number 200 sieve.

The sample shall be so taken that it will represent an average of all parts of the shipment. One shovelful shall be taken from each 3 tons of material, but not less than 10 shovelfuls per shipment. The sample thus taken shall be broken to 1-inch pieces, mixed, and "quartered" to provide a 15-pound sample for the laboratory. Three per cent of the number of packages shall be selected from different parts of the shipment. A sampling tube shall be used which takes a core of not less than one-half inch in diameter. The tube shall be so inserted into the package that it shall pass substantially the entire length of the package, so as to take a core of the material being sampled from substantially the entire length of the package. Material thus taken from individual packages shall be thoroughly mixed and "quartered," and the sample for testing shall not be less than 15 pounds taken from the material so drawn and prepared. Quicklime, lime powder, and hydrated lime are apt to air-slake. Sampling must, therefore, be conducted as expeditiously as possible in a cool, dry place, and the container for the laboratory sample must be

proximately 10 g in a platinum crucible and ignite to constant weight at a temperature of 1,000 to 1,100° C., preferably in an electric furnace. The product obtained by this ignition is to be analyzed to determine the chemical composition of the limestone.

If the material to be tested is quicklime, grind to pass a Number 100 sieve. Place a 5,000 g sample in a 200 cc flask with 75 to 90 cc of freshly boiled distilled water. Boil gently for 3 minutes. Cool to room temperature. Add 40 to 45 g of commercial white granulated sugar (sucrose) completely dissolved in 40 cc of hot freshly boiled distilled water. Shake vigorously with a rotary motion of the flask, keeping the lime in suspension for 30 minutes. Fill to the mark, mix and filter, rejecting the first runnings. Pipette off 100 cc of the filtrate and titrate with 1.785 normal nitric acid (1 cc= 0.050 g CaO), using phenolphthalalein as indicator. The cubic centimeters of acid used, multiplied by 2, equals the percentage of sugar soluble lime in the sample as tested. Convert into per cent on nonvolatile basis.

The magnesia determination is made after removing silica, iron oxide, alumina, and lime. Ignite 1 g of the sample strongly in a platinum crucible for 15 minutes. Cool, and weigh to obtain weight of nonvolatile sample taken. Moisten the residue and dissolve it in 1:1 hydrochloric acid, evaporate to dryness on the steam bath, take up in 5 cc of hydrochloric acid, add 50 cc of water, and filter off the silica. To the filtrate add 5 cc of hydrochloric acid, then make it slightly alkaline with

ammonia, heat to boiling, and filter off the oxides of iron and aluminum. Acidify the filtrate slightly, heat to boiling, add ammonium oxalate slowly to excess, then ammonia slowly until in slight excess. After the precipitate has settled for one to two hours filter and wash with an ammoniacal ammonium oxalate solution. Reserve the filtrate. Ignite the precipitate. When cool moisten it, dissolve in hydrochloric acid, and reprecipitate. Filter off the calcium oxalate, washing with ammoniacal ammonium oxalate solution. Discard the precipitate, combine the filtrate with the first one, slightly acidify with hydrochloric acid, and add an excess of microcosmic salt. Then slowly add ammonia until a crystalline precipitate forms or the solution is alkaline. Finally add one-fifth of the volume of ammonia water in excess. After the precipitate has fully formed, preferably by standing over night, filter and wash with dilute ammonia water (5 per cent by volume). Dissolve the precipitate in a slight excess of hydrochloric acid, add one or two drops of phosphate solution, and reprecipitate by adding ammonia while stirring, finally adding 2 or 3 cc of ammonia in excess. Filter, wash with 5 per cent ammonia, and ignite to constant weight. Weight of magnesium pyrophosphate x 0.3621=weight of magnesium oxide.

To determine the loss of ignition, ignite 1 g of the sample in a platinum crucible to constant weight at a temperature of 1,000 to 1,100° C. To determine fineness, weigh out 20 g of lime powder or hydrated lime, transfer to a Number 200 sieve, and brush the material carefully with a camel's-hair brush until practically no more powder passes through. Transfer the coarse residue to a weighing capsule or watch glass and weigh. Multiply the weight by 5 and deduct from 100 to obtain the percentage passing the Number 200 sieve. If desired, the powder may be spread in a thin layer in the sieve, heated for 15 minutes in an air bath at 100 to 110° C., and while still hot brushed through the sieve as described above. All sieves used in testing shall meet the requirements of the United States Standard Sieve Scale, Bureau of Standards Letter Circular 74.

Agricultural Gypsum

By Dr. W. E. Taylor, Head of the Soils Culture Department of Deere and Company

In this article on Agricultural Gypsum Dr. Taylor, who is Head of the Soils Culture Department of Deere and Company of Moline, Illinois, has struck a dominant note in the use of ground gypsum in the poultry business. Observe in this article how the flock, after many of the fowls had died from the "flu" epidemic, was benefited by ground gypsum which was freely dusted about the premises where the chickens were kept. It is also interesting to note that thousands of men who work in gypsum mills, where the dust from the ground gypsum impregnates the air, are particularly free from coughs, colds, and tuberculosis.

—Editor.

RECENT experiments have demonstrated the fact that gypsum (calcium-sulphate), commonly known as land plaster, possesses a high fertilizing value, and in addition if properly used will prevent fertility from going to waste. It is also a splendid disinfectant in foot-and-mouth disease and poultry diseases, and is said to be a cure for tuberculosis.

Gypsum is an untreated ground natural rock fertilizer, consisting mainly of hydrated calcium sulphate, or rather calcium and sulphur. Calcium is a very important soil element, and when it does not exist in sufficient quantities, crops of all kinds are not able properly to absorb and use the other food elements. It also has the effect of lightening clay soils, making them friable and of good physical condition.

Sulphur, an element in gypsum in the form of sulphate, is necessary to all plants, but its greatest value is in the production of legumes, especially alfalfa, clover, beans, vetch, peanuts and peas. It also enters extensively into the growth of onions, garlic and like plants.

Sulphate sulphur (part of gypsum) makes a wonderful increase in the growth of legumes by increasing the supply of organic nitrogen in root nodules, which is changed through the action of bacteria into nitrates, often increasing the yield of alfalfa from 100 to 300 per cent.

The remarkable effect of gypsum in increasing the yield of legumes and many other crops is in part due to the fact that it decomposes the silicates in the earth and renders soluble the potash bound up or dormant in those silicates. This action of gypsum is of great benefit to crops, especially those that are heavy users of potash.

Gypsum is also splendid for lawns if applied early in the spring or mixed with lawn seed when it is sown. Gypsum may be sown on the land before the seed is planted, or at the same time, using a fertilizer attachment to the drill, or broadcast sower. It can be applied with a lime-sower with splendid results to growing alfalfa, clover and bluegrass early in the spring. The amount to apply ranges from 200 to 500 pounds per acre.

It is estimated that each year more than $800,000,000 worth of nitrogen, the most valuable and important of all plant food elements, is lost through the evaporation of ammonia from urine and solid excrements from livestock. Gypsum applied to stable floors, gutters back of cattle, or to manure as it is placed in concrete pits, will stop the waste of nitrogen and also prevent that disagreeable odor of ammonia in cow and horse barns. The preservation of nitrogen is brought about through the property gypsum has of recombining ammonium-carbonate, which is very volatile, into a firmly fixed salt of ammonia, (ammonium sulphate). In addition to saving nitrogen, which is worth 30 cents a pound, it improves the sanitary and living conditions of the livestock, and of those in charge, and prevents the odors from being absorbed into the milk. The amount to use ranges from three to five pounds an animal each day, or about 100 pounds for each ton of manure.

If soil is deficient in phosphorous, as most of our soils in this section are, it is a splendid plan to mix and apply rock phosphate with gypsum. Any doubting farmer will be convinced of its efficiency if he will make one trial. I would suggest that a trial be made on a one- or two-rod strip, through your alfalfa field. However, gypsum will not take the place of lime to sweeten sour soil.

One authority states that gypsum inhaled in the powder form has cured tuberculosis in human beings. The same authority further states that observations made by veterinarians in Germany support the contention that persons suffering from tuberculosis who have entered the employ of gypsum mills, have been cured of pulmonary tuberculosis, and they also contend that, if cattle afflicted with tuberculosis are permitted to breathe gypsum dust and gypsum is used in the barn to destroy the fumes of ammonia, the cattle recover. It is also recommended as a preventive of the disease. In view of the prevalence of tuberculosis among dairy cattle, the plan of using gypsum as a cure or preventive is worth trying. A dust can be formed by using a dust gun or dust sprayer, once or twice daily. While I would not care to guarantee that gypsum will cure tuberculosis in cattle, I do feel, in view of what appears to be reliable evidence, that a trial is certainly worth while.

German authorities make the statement that foot-and-mouth disease is not apt to occur where gypsum is properly used in the stables. Gypsum is far superior to lime to use in the poultry house. Lime dust is an irritant, causing a rawness of the mucous membrane, making the poultry more subject to disease, while gypsum is palliative, disinfecting, and destroys the germs of disease. If scattered on the droppings it prevents the escape of ammonia, and if dusted in the poultry house it will keep the fowls' breathing apparatus in a healthy condition.

Recently gypsum was tried out at my request and under my observation in the prevailing poultry disease. About two-thirds of the flock had died of the disease or were killed because of their serious condition, before the gypsum was used. Everything in the poultry house was dusted with gypsum and a liberal supply left on the floor mixed with the litter. Subsequently more applications were made. While I will not recommend gypsum as a sure cure, none of the chickens died after the second day, and after two weeks, the entire flock was perfectly healthy and has remained so since. Gypsum is now being used in the brooding house, where two hundred young chicks are kept, and thus far none have died and all are well and thriving. These demonstrations have convinced me, and the poultry man in charge of the chickens, that gypsum is a wonderful disinfectant having marked curative qualities.

Organizing the Plant to Fight Fires

Written Expressly for PIT AND QUARRY by Dwight Ingram*

FIRE is the most serious menace to our business. It destroys more sand and gravel plants than tornado, flood or bankruptcy. And right now is the time of year when the spectre of fire looms in its most disastrous form. As we are coming into full stride in the producing season, a bad fire would wipe out the year's business and it becomes vitally important to safeguard property in every way against loss.

Most of the fire hazard of a producing plant can be eliminated before it has a chance to cause trouble. Provision can be made for handling oily rags in covered cans. A "no smoking" rule can be enforced. Metal lockers can be provided for workmen's clothes, because fires often start in these from spontaneous combustion or from a man's pipe that has been tucked in a coat pocket still lit. But after all obvious precautions of management have been taken, we know that some hazard still remains. Whether it may be the sudden crossing of electric wires or the carelessness of an employee, something may start a fire in the best regulated plant. In the last analysis, therefore, there is only one way to make sure that fire will not consume your property during the operating season. That is to "put out the fire before it starts" by providing a substantial amount of protective apparatus.

Plant fire protection includes three separate functions; (1) the prompt discovery of any blaze, (2) a carefully worked-out system for summoning the fire fighting apparatus; and (3) adequate equipment and trained men to extinguish any fire.

Discovery of fire is vitally important, because it is obvious that any blaze in its incipiency is small enough to be put out by a pail of water. The first step in coping with the fire menace, therefore, must be to find a way to detect fires promptly. During working hours there are usually enough men in all parts of the plant to take care of this problem without any special provision. At night, though, and during the day on holidays when the plant is not in operation, some plan must be made for detecting fires. Electric automatic fire alarms and automatic sprinklers take care of this problem in a mechanically perfect way, but for the average plant their cost is prohibitive. A reasonably efficient system for detecting fires is the night watchman. To be efficient from the fire standpoint, watch service should include the days when the plant is shut as well as nights, because such hazards as spontaneous combustion in oily rags and crossed wires are just as likely to make trouble on, say, Sunday afternoon as on Tuesday night. The theory of standard watch service is that someone visits every corner of the plant at least once an hour. To effect this surely, the watchman's hourly rounds are either punched on the dial of a portable recording clock or his stations at various points in the plant are connected by electric signal with a central fire alarm station where his failure to report on time is taken as evidence that there is something wrong at the plant. For the small plant whose income will not support a watchman the best safeguard is to have the superintendent personally go through the plant after all of the hands have left and look in all corners for rags and cigarette stubs.

After fire is discovered, the next logical step is notifying the fire department or summoning the local brigade. This notification in some plants is done by the same agencies that detect the fire, such as the automatic electric alarm, automatic sprinklers or the watchman. It may also be done by telephone, and locally by running a fire gong or blowing a designated number of blasts on the whistle. The precise method of notification or spreading the alarm is just a matter of applying common sense to a study of local conditions. Any system is all right if it is simple and if everybody understands it.

The third element of preparation for fire is the provision of extinguishing apparatus. At the outset of this discussion a warning should be given. We can give a list of good general rules for average conditions. But

*Engineer—Moore, Case, Lyman and Hubbard.

one never finds "average conditions" in real life. Every plant is a specific problem and requires individual analysis. Before embarking on a plan, therefore, each producer should call in an insurance engineer and an officer of the nearest public fire department. This procedure will guarantee the most efficient system for local conditions.

Automatic sprinklers are by far the outstanding agent for extinguishing fires. Except for the few causes where a mechanical defect impedes their operation, sprinklers do put out fires. The first sprinkler head "goes off" while the fire is still tiny and in most cases one or two heads will have the fire out before the engines have reached the scene. The only limitation on sprinklers is expense. Generally speaking a plant must be worth $100,000 or more to justify the cost of installing the equipment, and this puts it beyond the pocketbook of many producers.

Every fire at the outset is no bigger than a waste basket. A small quantity of water used intelligently at the start of a fire is more effective than the work of an entire fire department five minutes later. That is why it is vital in every plant, big or small, to have enough extinguishers or water barrels scattered throughout so that an employee will never have to run more than thirty-five feet to the nearest equipment.

First aid appliances are essentially what the name implies: apparatus always close at hand for immediate use when needed. They are only designed to cope with fires in their incipiency and can never be regarded as a substitute for automatic sprinklers or fire hose and hydrants. Several kinds of first aid appliances are approved by the Underwriters' Laboratories in view of the fact that there are the following three general classes of incipient fires: "Class A" fires, which are in ordinary combustible material (like wood or hay) where the quenching and cooling effect of water or solutions containing water is of first importance; "class B" fires, in small quantities of inflammable liquids (oil or gasoline) where a blanketing effect is essential; "class C" fires, in electrical equipment, where a non-conducting extinguisher is needed. These classes of fires are so vitally different that an extinguisher which is recommended for one might be useless or even dangerous for another. For instance, squirting water on electrical equipment might pass a short circuit back through the operator of the extinguisher and seriously injure him, while water poured on oil will merely spread the fire.

As a practical matter, this classification of fires as "A", "B" or "C" means this; extinguishers provided for a garage (which is class "B" because of the oil and gasoline) and for the engine room or transformer house (which are class "C" because of the electrical equipment) should contain carbon tetrachloride or foam, which do not conduct electrical currents and which put out fire by smothering instead of cooling as water does. All other buildings (office, factory, etc.) are class "A", and the best extinguishers are based on water. These may be 2½-gallon soda and acid type, an approved 5-gallon pump tank, a 50-gallon metal water cask with three buckets, or other devices approved by the Underwriters' Laboratories. Under ordinary conditions there should be one extinguishing unit for each 2500 square feet of floor area, or at least one for each floor of each building.

It is extremely important that the instructions regarding maintenance should be carefully followed so that the first aid fire appliances will be always fully charged, in their designated places, and in operative condition. Producers should note that the soda and acid chemical, which is widely used and very efficient, cannot be used in unheated buildings, because it will freeze up in the winter. For such places a pump tank should be used, because the water in it can be mixed with calcium chloride to prevent freezing. Both the soda-acid and the foam extinguishers have to be recharged every year because the chemicals in them deteriorate and if left alone they might be found out of service when most needed. Spare charges should be kept on hand in case the extinguishers need to be refilled in an emergency.

There are larger extinguishers, usually manufactured in 17-, 33- and 40-gallon sizes and mounted on wheels. One of these is a valuable accessory in a plant because they are easier to handle than fire hose and they contain enough liquid to put out a fire of some size.

Every producer must recognize that, no matter how thorough his system, there is still a chance that a fire will not be promptly detected, that the fire department will not be available or that first aid appliances will fail to control it. It therefore becomes necessary to have plant equipment to cope with large fires. This means water under enough pressure to reach the farthest corner of the plant and enough hydrants scattered through the premises so that it will never be necessary to play a hose stream more than 300 feet long (preferably not more than 200 feet long) in order to cover the entire property. Such hydrants should be for fire service only and any other use for them should not be tolerated; otherwise they may be found out of order when most wanted. Yard hydrants should be of a standard type and wherever possible should be placed about fifty feet from the buildings. Where it it impossible to place them at this distance, they may be put nearer, provided they are set in locations where the chance of injury by falling walls is small, and from which men are not likely to be driven by smoke or heat. Hydrants should be set on flat stone and about half a barrel of small stones should be placed about the bottom to insure quick drainage from the drip. They should not be placed near retaining walls where there is danger of frost through the wall.

The piping used to supply yard hydrants should be of cast iron and at least six inches in diameter under all circumstances. There are two methods of laying the yard pipe to have the pipe extend to a dead end or to have a circulating loop. The dead end system is just a simple laying of pipe from the source straight to the last hydrant. It is generally undesirable because there is very little pressure for the last hydrant at the dead end, and if a hydrant near the beginning is used there is practically no water available farther down the line. The circulating loop is a continuous pipe encircling the plant so that water coming into the system can flow in either direction. With such a pipe the opening of one hydrant will not take all the water away from the others, since water would then flow in from the other end of the circuit.

The depth of covering over underground water pipe will depend on local conditions, and will vary from 2½ feet in the southern states to 10 feet in northern Canada. In a loose, gravel soil, or in rock, the depth should be greater than in compact, clay soil. A safe rule is to bury the top of the pipe not less than one foot below the lowest frost line for the locality. As there is normally no circulation of water in private fire mains, they require a greater covering than service pipes.

Hose and couplings for private systems should be interchangeable with those of the nearest public fire department, for obvious reasons. More detailed information in this article is undesirable because so many angles of the problem of fire protection depend on peculiar local conditions that every system should be laid out by a fire prevention engineer.

One further mechanical appliance for fire protection that should be considered by every producer is the lightning rod. Protection against lightning is especially advisable on country buildings, on isolated buildings, and on all buildings wherever located having elevated features such as tall chimneys, flag poles, and gable roofs. Lightning rods and connections are tested by the Underwriters' Laboratories, and there are so many approved types on the market that the buyer is almost certain to get an efficient instrument. The only warning necessary, then, is to make sure that the rod is properly installed. Practically that means, be sure that it is securely grounded in one of the following three ways: (1) by connecting the conductor to underground metallic water pipe (not gas pipe) at a point outside of the building; (2) by connecting the conductor to ground plates deep enough to be in contact with permanently moist earth; (3) by extending the base of the rod down into permanently moist earth.

The key to handling fire in an industrial establishment is to have a private plant fire brigade. This sounds too pretentious for practical use, too expensive for the small producer and too much of an interference with money making for the large one. Expressed in other terms, though, a private fire brigade is simple, for it really means nothing

more than having a definite system for coping with such an emergency as fire. In the very large plant this might require the employment of full-time firemen, but for most producers it involves nothing more than a simple training for the regular employees. The secret of handling fires is a prearranged plan. In emergencies men do not act in unison. So the intelligent employer assigns definite duties for each man in advance, and for convenience calls this system the plant fire brigade.

Every fire brigade needs the two fundamentals of rigid discipline and the backing of the management as being a useful and permanent part of the plant organization. The size of the brigade, the amount of its equipment and the frequency of drills, however, will vary according to the size of the plant and the degree of fire hazard.

In the typical plant of our industries let us say that we have an average of about twenty employees. In such a plant every man would be needed for emergency service in case of fire. It would not be wise, however, to say that every man belonged to the fire brigade. The first step in organization would be to appoint a chief. He should be a man with mechanical training, such as the master mechanic or a department head or superintendent, and above all he should have the personality to command men. A lieutenant or assistant chief should also be appointed to assume command in the absence of the chief. He should have the same qualifications and both officers should be trained in first aid to the injured, such as resuscitation from electric shock or asphyxiation.

Under the chief and his lieutenant should be assembled a brigade of ten men. This number allows four men to each of two lines of hose with two utility men for handling extinguishers and other first aid appliances. Regardless of what duties these men are assigned to, they should all be trained to use all the fire apparatus in the plant so that "in a pinch" they are interchangeable. They should be able to throw water from buckets effectively, to lay hose and make connections, to hold a nozzle under pressure, and should also have a practical knowledge of ladders and knots and hitches.

The only way to make men act rationally in an emergency is to have them go through the motions so often beforehand that when the emergency comes it seems just like an ordinary bit of routine. Applying this principle to the fire brigade indicates that drills should be held at least twice a month. These should be held under full discipline and on paid time. The work of laying hose should be done rather slowly during practice in order to insure thoroughness. Speed will come naturally under stress if the men have been trained to accuracy. The location of the drill should be changed each time so that the men come to know every corner of the plant and its potential fire hazards. Going through the full form of putting out a mythical fire is, of course, a good system for drills, but it carries with it the objection that it disrupts the producing work very much. A system that is just as good and will not interfere so much with production is to have regular fortnightly drills at stated, convenient hours for handling apparatus, with occasional unannounced alarms just to test the speed of assembling the men. The first two or three drills should be held under the instruction of a professional fire chief or captain, and at least one drill a year thereafter should also be observed by such an officer for the sake of his criticism.

The handling of apparatus at drills should closely approximate actual fire conditions. It should embrace the making of hose connections with hydants, unreeling and stretching hose without kinks, coupling and uncoupling, attaching play pipes, carrying hose up ladders, over roofs and through the interior of buildings. As a general rule water should be turned on for all practice work except during freezing weather. And at times, when conditions are favorable, a sufficient number of hose lines should be stretched to test the maximum working capacity of the water mains and pumps.

Of the twenty men employed in the typical plant which we are considering, we have assigned only ten or twelve to the fire brigade. We intend, however, to give definite emergency duties to all the others. The engineer should stand by the water pump. One man in the office should be responsible for telephon-

ing or otherwise notifying the nearest fire department and sticking at this assignment until he produces it on the premises. Two other men should protect office records, covering them with tarpaulins or removing them to a place of safety and standing guard to prevent pilferage. Any other available employees can be trained to cover machinery to protect it from water damage, to close doors and shutters to cut off drafts, or to shut off all oil or gas valves. These protective measures are just as important as the work of the fire brigade and should be rehearsed at the time of each fire drill.

The outline of a fire organization which is given above can be easily adjusted to fit every plant. Those with fewer than twenty men will have to delegate to one man the duties which we have divided among two or three. In larger plants the fire brigade which we have described may be considered as a unit or company for each department and a general chief set over all the companies. Where the plant is big enough to warrant organization of three or more fire fighting units, it is advisable to make up one company especially among the maintenance crew, including the electrician, steamfitter, millwright, etc.

Most fires ought never to happen, because they are usually due to carelessness. But if they must come, it is important to provide the protective equipment adequate to extinguish them, and then train your employees for the emergency so that your profits and your business can not be wiped out by an hour's flames.

April Failures High

The number of commercial failures in the United States rose again during April, totaling 1,939. This is 80 more than the number for March, and is 232, or 13.6 per cent in excess of the 1,707 defaults for April, 1924. It is, moreover, the largest number reported for April since 1922.

Despite the increased number of failures, however, last month's liabilities of $37,188,622, although $3,184,000 above those for March, are about $11,715,000 below the $48,904,452 of April, 1924. This is a decrease of 24 per cent, and it is necessary to go back to 1920 to find an April indebtedness smaller than that of this year.

Non-Metallic Minerals

Raymond B. Ladoo, General Manager, Southern Minerals Corporation, and Technical Director, Eastern Magnesia Talc Company, has presented in his book, "Non-Metallic Minerals," the first complete compilation of essential data on the occurrence, preparation, and utilization of the non-metalic minerals. The book treats of the compostion, properties, mining preparation, market values, specifications, tests and uses of these minerals.

The book contains material gathered from many authoritative sources, published and unpublished reports of state and Government agencies, technical articles, correspondence and conferences with producers, consumers, engineers, chemists, geologists, and from the personal experience and observation of the author.

Practically all of the non-metallic minerals of any commercial value are treated. The book should be in the library of every producer of non-metallic minerals. It will prove to be of value to all who deal with minerals in any manner. The book is published by the McGraw Hill Book Company.

Federal Motor Sirens

In its new catalog, "Federal Sirens," the Federal Electric Company of 8700 South State Street, Chicago, presents its line of electrically-operated signals. The Federal Siren supplies the need for an electrically-operated sound signalling device for starting and quitting in mines, quarries, factories and industrial plants. It is claimed to be the first signal of its kind on the market, superseding the old steam or compressed air whistle, bells, gongs, etc., and introducing a sound different from all other city noises and easily distinguishable above them all.

Federal Sirens are also made for use on trucks and automobiles, motor boats, and for use as fire alarms in the smaller cities, towns and villages where fire protection is rendered by volunteer firemen. Here the Federal Siren gives notice to the volunteers and brings them to headquarters with shortest possible delay. The Siren tone is nationally recognized as a fire call. The company also makes handy folding electric lanterns.

Graphite in 1924

The graphite industry in the United States suffered a considerable setback in 1924, according to a statement given out by the Department of the Interior, as shown by figures compiled by the Geological Survey in co-operation with the State geological surveys of Alabama and Michigan. The output in 1924 was 4,971 short tons, valued at $87,510, as compared with 6,038 tons, valued at $190,944 in 1923. Of this output amorphous graphite amounted to 4,071 tons, a very slight increase as compared with 1923, and crystalline graphite amounted to 900 tons (1,800,000 pounds), as compared with 1,982 tons (3,964,000 pounds) in 1923, a decrease of 55 per cent. During the World War—both before and during our participation in it—the graphite industry in the United States flourished and reached its highest output and value. With the cessation of hostilities the demand fell off, and the sales decreased markedly in 1919. In 1920, in line with the general prosperity, the output increased, but it fell off again and reached its lowest output and value in many years in 1921. In 1922 and 1923 the trend was upward and increases were made. The manufacture of artificial graphite at Niagara Falls, N. Y., also decreased markedly in 1924, 10,896,192 pounds being manufactured, as compared with 1923, when the output was 26,761,015 pounds.

Week's Car Loadings Set Record for Year

The railroads of the United States handled more freight traffic in the week ended April 25 than in any previous week of the current year, according to the American Railway Association. The total was 959,225 cars of revenue freight, an increase of 26,418 cars, or 2.8 per cent over the week ended January 10, the former 1925 high record mark. Compared with the preceding week this year, loadings in the last week of April were an increase of 36,427 cars, or 3.9 per cent, and they were also 80,838 cars, or 9.2 per cent, over the corresponding week last year. They were, however, 3,353 cars, or 0.3 per cent below the same 1923 week.

Loadings of merchandise and less than carload lot freight totaled 255,099 cars in the week ended April 25, 3,127 cars under the week before, but 7,212 cars over last year and 13,561 cars over two years ago. Miscellaneous freight loadings amounted to 361,107 cars, 1,392 cars in excess of the previous week, 33,398 cars over 1924 and 5,120 over 1923. Coal loadings totaled 147,330 cars, 13,158 cars over the week before and 29,758 cars in excess of 1924.

All districts reported gains over the same 1924 week, except the central western; while all, except the eastern, Allegheny and central western, reported increases of the same 1923 week.

A comparison by weeks follows:

	1925	1924	1923
April 25	959,225	878,387	962,578
April 18	922,778	876,916	953,042
April 11	917,284	880,937	945,271
April 4	922,375	861,990	896,375
March 28	931,395	907,389	896,735
March 21	909,363	908,290	916,818
March 14	924,149	916,762	904,116
March 7	930,009	929,381	905,344
February 28	862,910	944,514	916,624
February 21	925,295	945,679	830,187
February 14	902,877	935,589	816,646
February 7	928,244	906,017	849,352
January 31	896,055	929,623	865,314
January 24	924,254	894,481	896,464
January 17	932,150	894,851	864,297
January 10	932,807	872,023	873,908
January 3	765,727	706,292	727,246

INDUSTRIAL NOTES

The Industrial Works, Bay City, Michigan, manufacturers of locomotive cranes and crane equipment for more than a half century announce the opening of two new district offices, one at 425 Whitney Central Building, New Orleans, Louisiana, in charge of John A. Abele, District Sales Manager, and the other at 843-A Hurt Building, Atlanta, Georgia, in charge of John J. Murphy, District Sales Manager.

That company also announces the appointment of four additional District Sales Engineers. Douglas J. Calder, Conway J. Neacy and Monroe J. Frankel will have offices at the Chicago district office of the Industrial Works, 1051 McCormick Building, Chicago, Illinois and Chester F. Delbridge will be located at the St. Louis district office, Railway Exchange Building, St. Louis, Missouri.

These six men, although new to the Industrial Works organization are thoroughly trained and experienced crane sales engineers and the company now employing them trusts that all who are interested in Industrial Works products will use their services freely.

The Pennsylvania Pump & Compressor Company, Easton, Pennsylvania, has issued a well illustrated 16-page bulletin, No. 206, presenting its line of double suction, single stage, centrifugal pumps.

Concerning Waste Heat Recovery From Rotary Lime Kilns

By A. D. Flower, Waste Heat Engineer, Edge Moor Iron Company

THIS is the first of a series of opinions which will be published in Pit and Quarry concerning the application of waste heat systems to rotary lime kilns as a possibility for securing substantial savings.

We realize that such a possibility needs to be carefully investigated. In practically every case it is a question of plant layout. In comparison with the amount of fuel required there is little power needed for a lime plant. A waste heat system attached to a lime kiln will produce normally more steam than the plant could use. However, if a lime plant is so situated that it can utilize or sell the excess power from the kiln, the installation of a waste heat system could be made to pay for itself.

Readers are urged to submit their opinions on this problem. Material received will not be published without the author's approval or will be published anonymously if desired. It is our desire to bring to the attention of the lime manufacturer all the data possible on this interesting question.

Editor.

Although the recovery of waste heat from rotary kilns in the cement industry is now well established, and a large number of plants are already equipped with efficient waste heat installations, little has been done regarding the installation of waste heat boilers in connection with the rotary lime kiln. In the cement industry several plants are obtaining their entire power requirements from their waste heat boilers, and many others obtain the greater portion of their power in this manner, resulting in enormous yearly coal savings.

That these same methods of waste heat recovery and coal savings are applicable to the rotary lime kiln there is no question. There is the same continuous flow of hot gases with temperature changes confined to comparatively small variations. Also in the cement kiln, we have a pound of coal (or its equivalent) consumed for each six or seven pounds of raw material fed into the kiln; in the rotary lime kiln we have a pound of coal consumed in the gas producer (or equivalent fuel fired direct) for each six to seven pounds of rock calcined in the kiln. The quantity of carbon dioxide gas driven off from the charge is approximately the same in each case, and the gas weights, when referred to raw material, are therefore comparable.

The temperature of the gases leaving the lime kiln is not as high as usually obtained from the cement kiln (dry process) but it approaches this temperature and is sufficiently high to show very good returns when passed through a waste heat recovery system. In calcining lime rock in the rotary kiln, the burning zone at the front end of the kiln does not require the intense heat necessary for burning cement clinker and the temperatures at this end of the kiln will not exceed about 2350 to 2400 deg. F. A much longer burning zone is needed, however, and this results in the gases leaving the end of the kiln at temperatures of 1100 to 1300 deg. F. These temperatures of course depend upon many variables, such as diameter, and length of kiln, load in the kiln, pounds of fuel consumed per pound of rock calcined in the kiln, insulation of kiln shell, etc., but they are the approximate temperatures of gases that may be expected leaving the rotary lime kiln. With these temperatures, and gas weights as outlined above, the waste gases, when utilized in a properly designated waste heat system, will show a return of from 750 to 900 pounds of steam per ton of rock calcined in the kiln, depending upon the operating characteristics of the unit and upon the many variables outlined above.

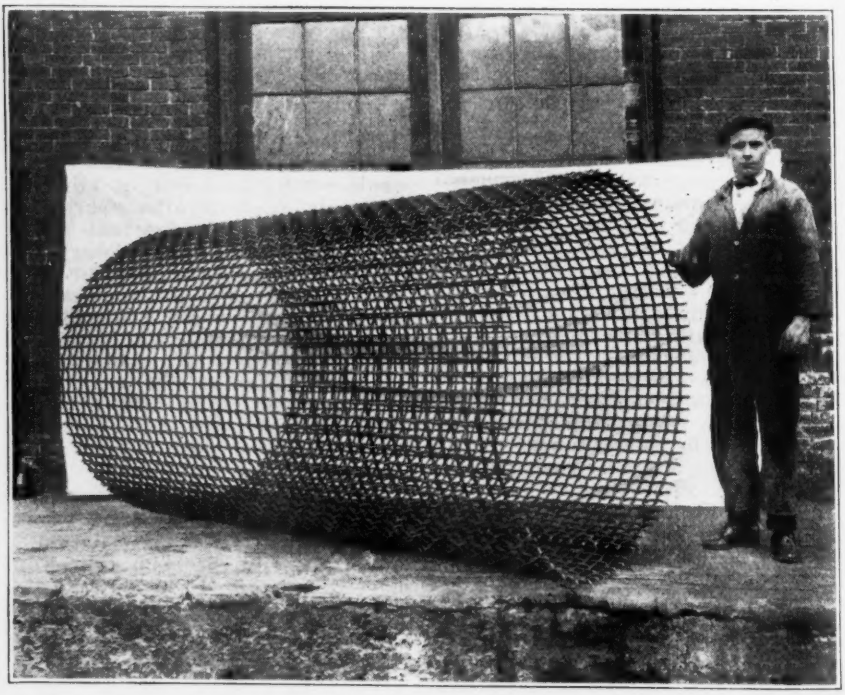
Whether the return in power would warrant the investment covering a waste heat installation, is an engineering problem that would have to be worked out for each individual plant, and no rule can be given covering the industry as a whole. Not only must the quantity of waste heat and probable steam recovery be determined, but also the power requirements of the mill and the

cost of such power, either purchased or manufactured, must receive consideration. Usually the power requirements of a lime plant are small and if they should be such as to utilize only a portion of the steam produced, then a ready sale for any excess current should be at hand or else other steam requirements available such as steam for the gas producers, shaft kilns, etc., to realize the fullest economy from the waste heat installation. In the average plant these conditions do obtain and when all of the steam produced from the waste heat can be thus utilized, there is no question but that a handsome return upon investment can be shown.

In general, the design of the waste heat unit would follow along the lines of the designs now used so successfully in the cement industry, including the air seals where the kiln enters its housing, economizers, fans, superheaters and special design of waste heat boilers. The unit would enjoy one distinct advantage over that of the cement kiln in the fact that the dust problem would not be nearly as troublesome. In a rotary lime kiln the raw feed to the kiln is nearly always a screened product, the sizes varying from ½ to 1½ inches and as uniform as possible. This of course eliminates the large quantities of dust carried off with the gases as met with in cement mill practice and makes the cleaning of the waste heat system on the rotary lime kiln a comparatively easy problem.

The Largest and Heaviest Rol-man Screen

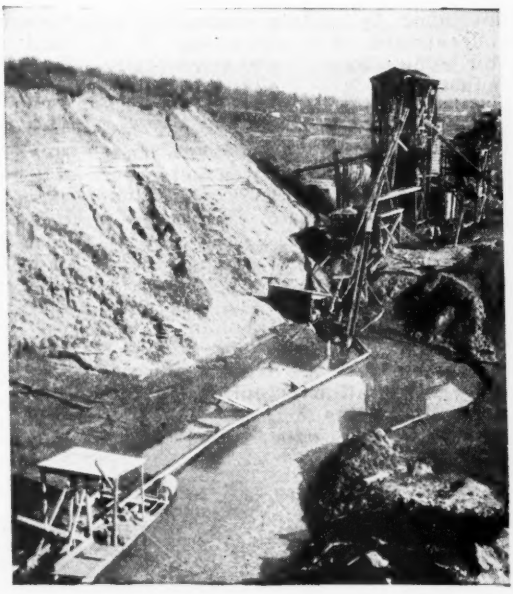
The illustration below shows the largest and heaviest screen the Manganese Steel Company have ever made. This is a Rol-man double lock mesh woven manganese steel rod screen with 1⅜ inch openings and 7-16 inch diameter rods. It is made in one piece 176 inches long, 90 inches wide and rolled to a 54 inch outside diameter with a 4 inch lap. The screen as shown weighs 715 pounds. The screen was made for one of the large crushed stone quarries in the Ohio District.



The Largest and Heaviest Rol-Man Screen Double Lock Mesh Woven Manganese Steel Rod Screen Made for One of the Large Crushed Stone Quarries.

Another record for Morris Pumps!

THE Ward Sand & Gravel Co., Oxford, Mich. operates the largest producing plant in the State and probably in the country. The capacity is 200 cars per day and the loading record, 31 cars in 62 minutes.



The picture shows how the material is obtained in a similar plant. The deposit above the water line is broken down by a low pressure stream from a 6-in. Morris Pump, and excavation from below water line is effected by two 16-in. heavy-duty Morris Dredging Pumps. The material is then conveyed hydraulically through about 1100 ft. of pipe line and lifted about 70 ft. to the screens.

The use of Morris Pumps in this and other big record-breaking plants is significant evidence of the correctness of Morris Engineering—but don't get the idea that Morris superiority is confined only to large units. We anticipate the needs of the small as well as the large user, and are ready to advise correctly for any producing conditions. If you are considering a new plant or overhauling an old, you have everything to gain by getting our free suggestions, or at least a copy of Bulletin 20.

Morris Machine Works **Baldwinsville, N. Y.**

Originators of Centrifugal pumps, both single and multi-stage, and builders for practically all purposes since 1864

Branch Offices: New York, 39-41 Cortlandt St.; Philadelphia, Forest Bldg.; Cleveland, Engineers' Bldg.; Chicago, 217 N. Jefferson St.; Boston, 79 Milk St.; Pittsburgh, 320 Second Ave., Detroit, Penobscot Bldg.; Charlotte, Realty Bldg.; Richmond, 708 Mutual Bldg., Houston, 119 Main St.

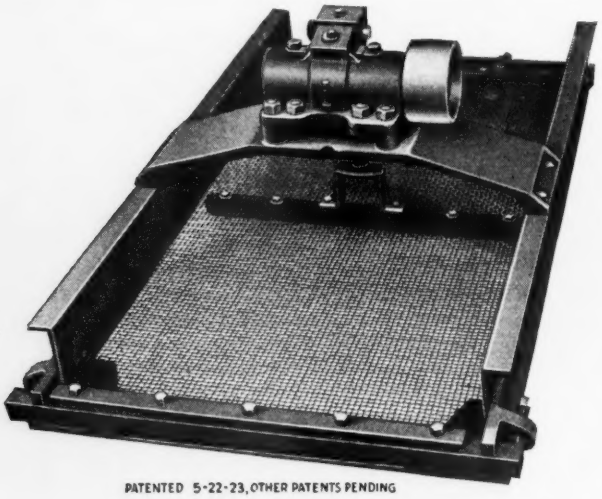
Sales Representatives: Buffalo, St. Paul, Kansas City, Denver, Salt Lake City, Seattle, Portland, Ore., Los Angeles, New Orleans.

MORRIS
CENTRIFUGAL PUMPS

The Leahy No-Blind Vibratory Screen

THE Deister Concentrating Company of Fort Wayne, Indiana, is manufacturing a screen known as the Leahy screen. This screen was developed by mining engineers for concentrated mill operation. It is now being offered to the non-metallic industries.

This machine, which is suitable for screening either wet or dry material from ¾ inch to 20 mesh, is made up of a wire cloth screen held taut in longitudinal tension in a stationary frame by means of tension bolts. A quick return differential vibration is transmitted from the vibrator through a connecting rod to a rigid member attached to and extending transversely across the underside of the wire screen cloth. The sides of the screen cloth are free to vibrate, and the vibration is uniform at all points in a line across the screen cloth.



PATENTED 5-22-23, OTHER PATENTS PENDING

The normal amplitude of the screen vibrator a more intense vibration is under the vibrator. The screen at the upper end has a slight vibration just sufficient to stratify the material, enabling the "fines" to pass through the meshes. More nearly under the vibrator a more intense vibration is present and is desirable for passing through the particles which are just under the size of the screen openings. The remaining area of the screen cloth finishes the process, accomplishing a new degree of perfection in a close sizing.

The screen is forced up into the bed of the material 1600 times per minute, and the anvil action at the end of each quick return stroke of the screen cloth clears the meshes, making each vibration effective. Its capacity runs from 7 tons of 20-mesh material per hour to about 30 tons of ¾-inch material.

The outstanding features of this machine are as follows.

A quick return differential vibration is transmitted to the entire surface of the screen cloth.

Particles of material coming on the screen are stratified according to their relative masses, and the finer particles are screened freely without hindrance by the oversize particles.

Anvil action at the end of each quick return stroke clears the meshes of the screen cloth, and the screen is non-binding.

The vibrator is mechanical, entirely enclosed and self-oiling; it is operated by a 3-inch belt, and requires only ¼ to ½ H. P. for its operation.

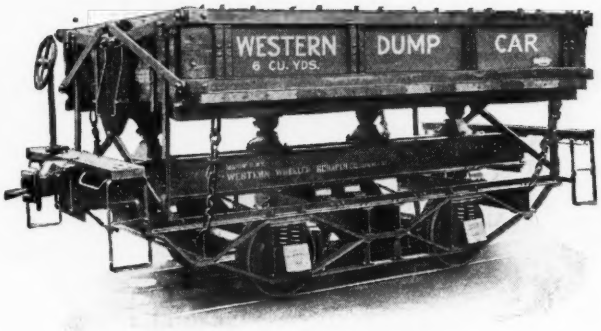
One spring adjustment controls the intensity of vibration, and adjust the vibration to suit the load and the material being screened. Rate of vibration depends on drive belt speed and may be changed to suit conditions.

Screen cloth is held in longitudinal tension by two bolts and can be changed in 5 minutes' time.

The Memphis Stone and Gravel Co., Exchange Bldg., Memphis, reports also increased activity in road work and railroad ballast work and steady operation at their pits and quarries in two or three states.

The Nurre Glass Co., of Bloomington, Ind., is erecting a large plant in Memphis at Pauline and the Southern R. R.

Does Your Haulage System Limit Production?



Western 6-yard Standard Gauge Dump Car.
This is the favorite car for pit and quarry work.

THE 1925 season is in full swing. Is your haulage system equal to the demands upon it? It is not economy to hold back production because your dump cars cannot stand the pace.

During the stripping operation at a Pennsylvania quarry, production was increased 50 percent, due to the cars alone, by the substitution of Western Dump Cars for the nondescript cars which had been in use. Western Dump Cars are always efficient and dependable and, having few castings which are very accessible, repairs are inexpensive and easy.

Let us suggest an installation and lay-out which will increase *your* production. Tell us your haulage conditions when you write for Catalog P-61.

SUCCESSFUL PERFORMANCE · G.C.M.A. · SPOF

WESTERN WHEELED SCRAPER COMPANY
Founded 1877

Western

Earth and Stone Handling Equipment
AURORA, ILLINOIS

QUICK ACTION

Will Save you 25% to 50% on this

New AUSTIN Machinery

Hundreds of contractors have filled their equipment needs here since this sale began in January. Over $300,000 worth sold. The items below are all that remain. Get busy! Buy now before what you want is sold.

90 **AUSTIN CONCRETE MIXERS,** Cube Hex and Drum Types, on trucks and on steel skids, with Fairbanks-Morse Novo and Hercules Engines; power loaders, wheelbarrow hoppers, water tanks, etc., capacities from 2½ cu. ft. to 21 cu. ft. of mixed concrete per batch.

8 **AUSTIN PAVERS,** Cube Hex and Drum Types, all mounted on full Multipedal traction, with distributing booms and distributing spouts, sizes 10-E to 21-E, with gas or steam power. Capacities 10 cu. ft. to 21 cu. ft. of mixed concrete per batch.

1 **No. 8 AUSTIN CRANE-DRAGLINE** (Convertible, mounted on full steel Multipedal traction; 50 ft. boom, steam power. Weight 134,000 lb. Capacity as Crane 25 tons, for Clamshell 1½ yd. bucket, for Dragline 2 cu. yd. bucket. Pneumatic control.

10 **No. 3 AUSTIN SIMPLEX CRANES - CLAMSHELLS,** mounted on full steel Multipedal traction, 35 ft. booms, box girder type; steel cabs; 5x6½ Climax gas engines. Capacity Crane 5 tons; capacity Clamshell ¾ cu. yd. light type bucket. Pneumatic control—very fast and smooth. These are the fastest and smoothest working cranes of their size ever built.

1 **No. 5 AUSTIN CRANES-DRAGLINES** (Convertible), mounted on full steel Multipedal traction, 40 ft. booms; steam power. Capacity for Clamshell or Dragline 1 cu. yd. bucket.

We are selling for the account of a Philadelphia exporter who must dispose of this lot of machines immediately—hence the great price reduction of 25% to 50%. TAKE ADVANTAGE.

For prices and descriptions of any machines, write

Industrial Plants Corporation

National Liquidators

3500 Dorr St. **TOLEDO, OHIO**

Selling agents for Machinery and Metals Corporation, Philadelphia

"WE BUY—REBUILD—SELL OR RENT"

"SPECIAL"

LOCOMOTIVES

2—Porter standard gauge saddle tank cylinders 14 x 22, weight 42 tons, new last year.

4—Porter 36 inch gauge saddle tank 10 x 16 cylinders, weight 18 tons, new last year.

1—Davenport, standard gauge, saddle tank cylinders 10 x 16, weight 20 tons.

STEAM SHOVELS

1—Bucyrus 50B on caterpillars 1¾ yard dipper, 26 ft. boom, 17 ft. dipper stick, new last year.

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100	Westinghouse, type CS	870
100	Westinghouse, type CW, slip-ring	865
100	Westinghouse, type CS	580
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1—100 H.P. Foos Gas Engine.
A Complete Power Plant
NEW—A BARGAIN

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USED 4 PLY RUBBER CONVEYOR BELT.
19" x 3/8" x 280 ft.

Good condition. $275.00

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1—Marion Model 31 full revolving shovel, caterpillars, 1¼ yd. dipper. Priced to sell quickly.
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Dempster Building, Knoxville, Tenn.

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One Lidgerwood Cableway, complete: one 42" Raw Style Fuller Pulverizing Mill; one Foote Two-Bag Concrete Mixer with boiler; seven hundred feet of 6" steel Road Building Concrete Forms. **Address Box 51**
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2—100 H.P. Snow Diesel.
1—80 H.P. Venn Severin, used 2 mos.
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1—35 H.P. Muncie.
1—25 H.P. Fairbanks Morse "Y".
1—15 H.P. Fairbanks Morse "Y", used 2 mo.
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228'—10x10 Union, Class BL.
245'—10x10 Ingersoll-Rand.
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WANTED IMMEDIATELY

1—Cat. Shovel and Crane, preferably gas.
12—Either 1 ½-yd., 24-in. ga. or 4-yd., 36-in. ga. Dump Cars.
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THE ATLAS CAR & MANUFACTURING CO.
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Testing fire clay, limestone and other mineral lands, using double core barrels.

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WE DRILL FOR FIRE CLAY, LIMESTONE, SOAPSTONE, GYPSUM, ROCK SALT AND ALL OTHER MINERALS USING DIAMOND CORE DRILLS

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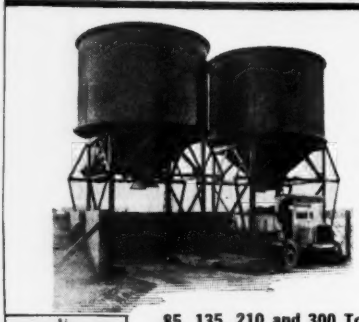

85, 135, 210 and 300 Ton Capacities.

All-steel-hopper-bottom-self-cleaning.

Equipped with a no-jam gate.

Use BLAW-KNOX long service Clamshells.

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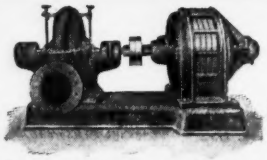

Single Stage High Head High Efficiency Centrifugal

Capacities 25 to 4,000 Gallons per minute.

Pumps for All Purposes

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A Mouthful at Every Bite

Guaranteed to do more work than any other bucket of like capacity

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Material in Stock
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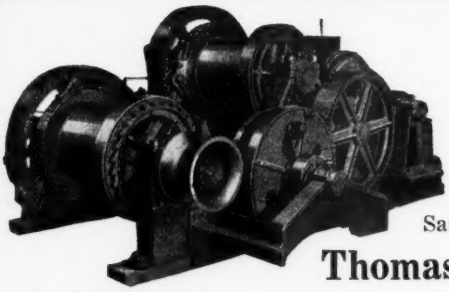


Thomas Hoists

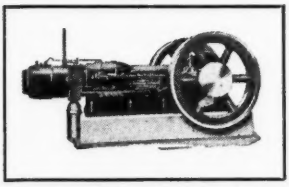
Steam and Electric

Single and two-speed types designed and built to meet every requirement of the Sand, Gravel and Stone Producer.

Thomas Elevator Company

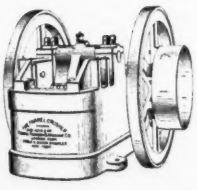
20 S. Hoyne Avenue — Chicago, Illinois

Buckeye Oil Engines Are Favorites



Single and two cylinder 55 to 260 H. P.
Horizontal accessible design with adjustable cross-head.
Cost least for repairs.
Burns low grade fuel.
One gallon lubricating oil operates 90 h. p. for 33 hours.
Write for catalogue.

THE BUCKEYE MACHINE COMPANY — **Lima, Ohio**



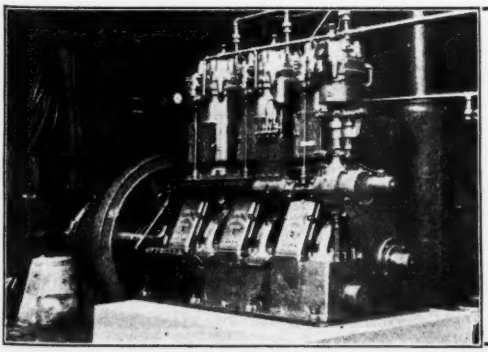
"FARREL" CRUSHERS

—World Famous—

Thousands in use on the hardest rock. Built in all sizes, 6″x3″ to 60″x48″. Complete rock crushing plants designed and equipped, also sand and gravel, washing and screening plants.

Send for latest bulletin E.

Earle C. Bacon, Inc., Engineers, 26 Cortlandt St., New York



TIPS OIL ENGINES burn low grade fuels. Solid Injection. 40—165 H.P. Sizes suitable for operating dragline excavators, hydraulic dredges and all stationary work. Variable speed, 100% water-cooled heads, no torches, Chrome-Vanadium crankshafts.

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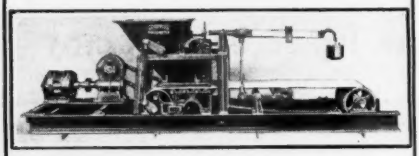
TIPS ENGINE WORKS
AUSTIN, TEXAS

Agents in all principal cities

NO SPRINGS

No delicate contrivances, yet a machine is not obtainable that will weigh more accurately than

THE POIDOMETER



Weight against weight is the principle upon which it operates, and it is distinctly automatic in action.

Enables materials to be handled continuously or in bulk as desired.

Catalog sent on request.

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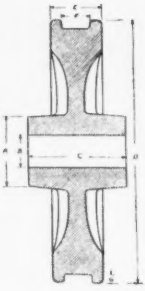
EGYPTIAN



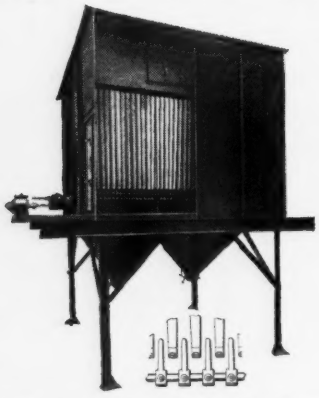
DOUBLE FLANGE TRAVELING CRANE SEMI-STEEL WHEELS

Egyptian semi-steel castings will meet the most exacting requirement for durability and service.

We suggest it would be to your advantage to place our name on your Purchase list for Egyptian Semi-Steel Crane Truck Wheels, Sheave Wheels, Gang Saw Truck Wheels, Channeler Wheels, etc.

Egyptian Iron Works
MURPHYSBORO, ILL.

Dollars From Dust

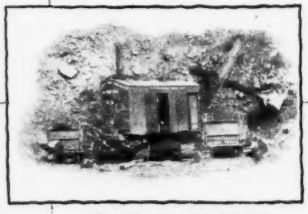


The Paxson Dust Collector collects 98% of the fine powder which floats in the air.

In many industries this collection of dust represents a direct saving of money—resulting from the recovery of otherwise lost values, and from the increased efficiency of labor as affected by improved sanitary conditions.

J. W. PAXSON CO.
Nicetown Lane & D Street Philadelphia

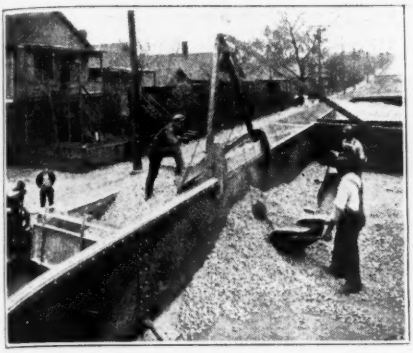
We are a going concern. YOU get the best Dust Collector. We can deliver the goods.



OSGOOD

is your guarantee of power shovel efficiency long life & excellent service — Look for the name OSGOOD on your power shovel — Revolving and Rail-road Shovels on Continuous Treads-Traction Wheels or Rail-road Trucks-¾ to 6 Yd Capacity. Clamshells Draglines Cranes. *Steam Gas Oil or Electric Powered.*

OSGOOD
Marion Ohio

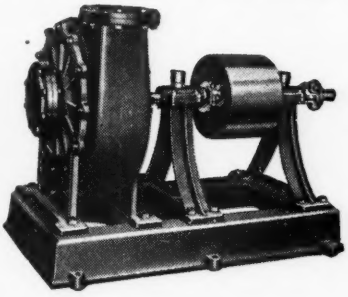


Baker Car Unloader

The ideal, inexpensive equipment for unloading sand, gravel, crushed stone, coal, etc. Its first cost is low and its operating cost is likewise low. Send for catalogue explaining the flexibility and economy of this equipment.

BAKER UNLOADER CO.
Omaha, Nebraska

LIGHTNING PUMPS



Will it stand the gaff?

It will if it's a Lightning Sand and Gravel Pump. Lightning Pumps have unusual wearing qualities in addition to large capacity and economical operation.

A complete description of these rugged pumps will show you why they are the right pumps for your work. Write for Pump Bulletin.

KANSAS CITY HAY PRESS CO.
KANSAS CITY, MISSOURI

McGANN MANUFACTURING COMPANY, INC.
Engineers and Manufacturers
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YORK LIME KILNS, as designed and built by us, give many years of service and produce uniform, high grade lime with a low operating and maintenance cost. Let us solve your lime problems.

YORK Kilns · SCHULTHESS Hydrators · YORK Double Shell Dryers

Milwaukee Gasoline Locomotives

For Industrial Haulage

BUILT in sizes from four to fifteen tons. For all Gauges of Track. There's a size for every purpose.

Write for Catalogs M-129 and M-136.

MILWAUKEE LOCOMOTIVE MFG. CO. MILWAUKEE WISCONSIN

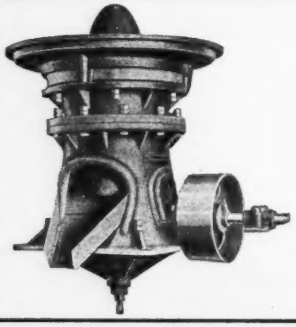
WOOD HAMMER DRILLS

SPEED — POWER — ECONOMY

Rapid, hard biting drilling ability is a feature of Wood Drills. They are easy in operation, durable and foolproof. Write today for the facts on this economical, efficient drill.

WOOD DRILL WORKS, 30-36 Dale Ave., Paterson, N.J.

Makers of Hammer Drills and Piston Drills



AUSTIN
Gyratory Crushers

Portable and Stationary Plants

Capacities, 5 to 300 tons per hour

Catalog 29Q tells the whole story. Write for your copy today.

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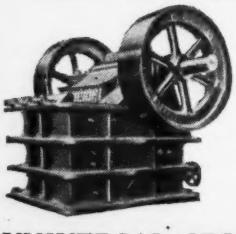
NEW YORK CHICAGO SAN FRANCISCO

PULVERIZERS

FOR AGRICULTURAL LIMESTONE
ASPHALT FILLER
ROCK DUST FOR MINES
THE GRIFFIN MILL—BRADLEY 3 ROLL
BRADLEY HERCULES MILLS
OUTPUTS—1-40 TONS PER HR. FINENESS—20-200 MESH.

BRADLEY PULVERIZER COMPANY
BOSTON Works: ALLENTOWN, PA. LONDON

ALL STEEL UNIVERSAL CRUSHERS



Used Everywhere

Portable or Stationary, with or without Elevators.

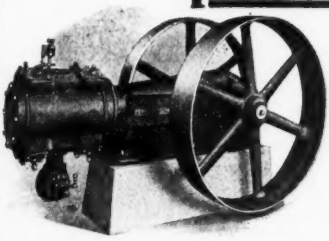
For Gravel Pits, Rock Quarries, Contractors, Road Builders, Counties, Cities — in fact wherever crushers are needed.

25 sizes with capacities to 450 tons per day.

Manganese Equipped Fully Guaranteed

UNIVERSAL CRUSHER COMPANY
619 C AVE., WEST
CEDAR RAPIDS, IOWA

PENNSYLVANIA



He told us frankly: "It is the best all around air compressor I have ever seen or had anything to do with." This was said of a PENNSYLVANIA Air Compressor.

Let us quote on one of this kind or send you **Bulletin No. 123.**

PENNSYLVANIA PUMP & COMPRESSOR CO.
Main Office and Works: Easton, Pa.

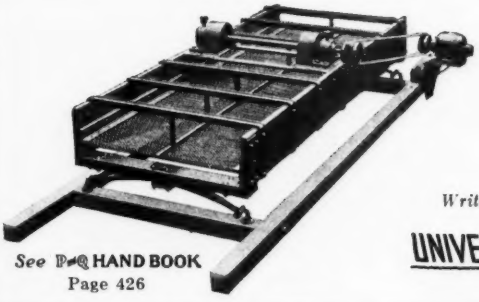
YOU CAN SEPARATE—

Agricultural Limestone from your Screenings
Or
Asphalt Filler from your Agricultural Limestone
Or
Air-Float from your Asphalt Filler
Or
Make Products of any Mesh from 80 to 350

With the

GAYCO DRY CENTRIFUGAL SEPARATOR

RUBERT M. GAY COMPANY, Inc. 114 Liberty St., NEW YORK, N. Y.



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Page 426

Universal Vibrators

The Most Economical Screens Made

Low Price
Low Power Cost
Low Up-keep

Write Today for Descriptive Catalog No. 50

UNIVERSAL VIBRATING SCREEN CO.
RACINE ~ ~ WISCONSIN

BAY CITY ONE MAN EXCAVATOR

Operates Shovel—Clam—Dragline

Fills the gap between hand labor and high priced equipment. Several hundred in operation, gasoline or electric power.

BAY CITY DREDGE WORKS
BAY CITY, MICH.

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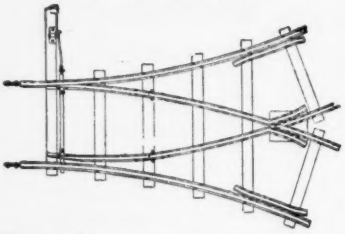
Kilby Frog and Switch Company

Birmingham, Alabama

Manufacturers of



We make a specialty of track material for all kinds of Industrial Tracks—such as Frogs, Switches, Switch Stands, Rail Braces, Crossings, Crossovers, Room Turnouts, Portable Track, Etc.

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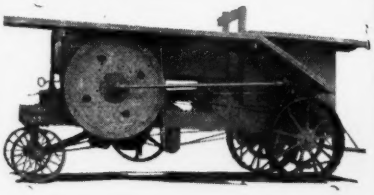


THE LATE IMPROVED LOOMIS CLIPPER

The most wonderfully efficient Blast Hole Drill produced. It is faultless, simple, durable, easily maintained; it commands your investigation. There is a reason why it predominates. Days are not too long, nor rock too hard for this famous Drill.

THE LOOMIS MACHINE CO.
15 MARKET STREET TIFFIN, O.

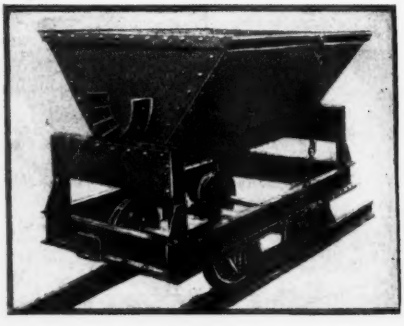
DIXIE
SWING HAMMER CRUSHER

Mogul Crushers will crush rock 14″ cubes down to 1½ and finer in one operation, at less cost per ton than does any other hinged hammer crusher.

It is built stronger, it is simple, then why should it not be best? If in doubt, ask a user.

Any size you need, send for full specifications.

DIXIE MACHINERY MFG. CO.
3661 Market St. St. Louis, Mo.



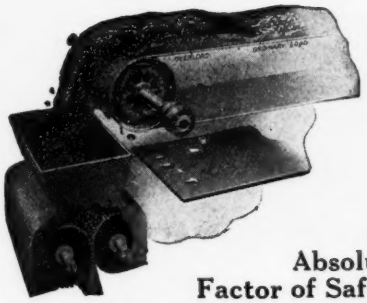
Best Dump Cars They Ever Used!

The Charles Warner Company have approximately 300 cars in operation, but Gehret Side Dump Cars, they claim, are the best they have ever used, and after trying many makes, they will use no other.

Gehret Cars are one-yard capacity side dump, and weigh about 450 lbs. more than other makes of the same capacity. Rockers are equipped with steel pins and bumpers, and boxes are very heavy. The brass bearings stand hard usage. Write today for circular.

GEHRET BROTHERS, Inc.
Bridgeport, Montgomery County, Pa.
Manufacturers of Structural Steel and Ornamental Iron Work.

HIGH DUTY Magnetic Separators



An Absolute Factor of Safety

The ventilation feature of the High Duty Magnet Pulley increases the magnetic power 25% to 50%. This increased power provides a practically absolute factor of safety from tramp iron even with peak loads.

One Piece of scrap iron may cost you more in crusher repairs than the price of this inexpensive magnetic device.

Write for details and price.

Offices in principal cities
See telephone directory

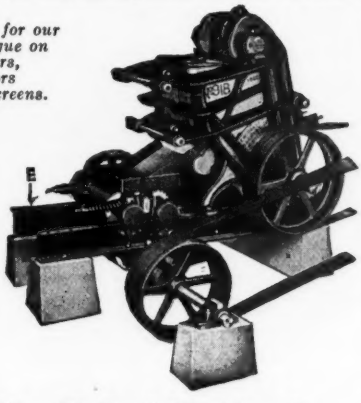
MAGNETIC MFG. CO.
201—24th Ave. Milwaukee, Wis.

—New Holland—

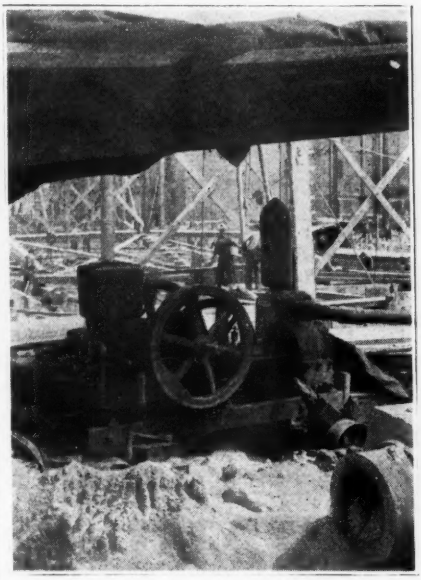
Hard or soft Limestone Crushed equally well

Whether your stone is hard or soft makes little difference to this powerful, hard crushing machine. Main frame is of semi-steel, main shaft of high carbon steel, and bearings are lined with heavy pressure bearing metal. Made in five sizes.

Write for our catalogue on crushers, elevators and screens.



New Holland Machine Co.
Franklin Street, New Holland, Pa., U. S. A.



A REAL PUMP!

Whatever it may be that you have to remove in clayey, limey, or muddy water—the "DOMESTIC" Pump will carry it away. Contractors and quarry men find it an invaluable asset.

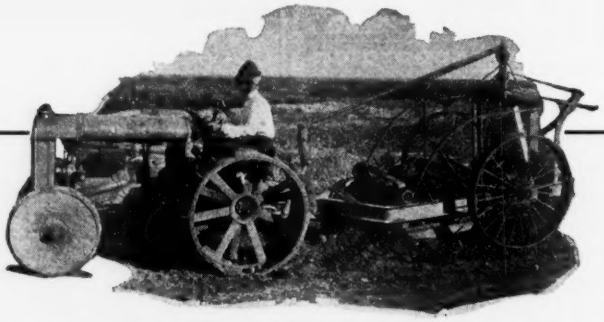
No odor or slop around the "DOMESTIC" Double Acting Trench Force Pumps. Will pump out pit or quarry bottoms, and discharge through long lines to disposal point. Maximum capacity—minimum weight.

If you have too much water or not enough at your plant, there is a "DOMESTIC" Pump for your job which will prove useful and economical.

Write for Bulletin "TP" when you have a pumping problem to solve.

Domestic Engine & Pump Co.

Shippensburg, Penna.



MOVE 100 YARDS OF DIRT OR CLAY EACH DAY WITH A MIAMI

Put a MIAMI (one-man) POWER SCRAPER on your stripping or dirt-moving job and cut your costs in half. One man will move one hundred yards every day a distance of two hundred feet or four hundred feet round trip. The total cost including interest, depreciation, gas, oil and operator is less than twenty cents a yard.

Hundreds of others have done it—you can do the same.

Let us tell you more about it and send you some actual cost records.

THE MIAMI TRAILER SCRAPER CO.
625 S. Clay Street **Troy, Ohio**

MIAMI FORDSON one man power **SCRAPER**

Reg. U. S. Pat. Off.

Consider the details of conveyor construction

Don't buy your conveyor equipment somewhere by the foot, and let it go at that. Look into the Idler question first.

Smooth running operation and absence of friction are what you will find when you investigate Conweigh Ball Bearing Troughing and Return Idlers. Durability is another quality. Conweighs are made of hardened steel, well reinforced, and give easy access for lubrication.

The many other outstanding features of Conweigh Efficiency you will appreciate.

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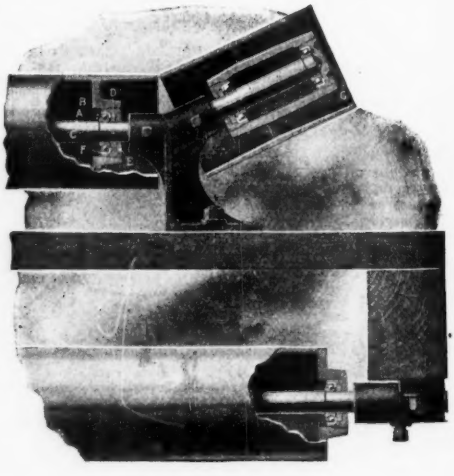

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90 West Street **ENGINEER & CONTRACTOR** **New York**

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AMERICAN
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"TRENTON"
DREDGE CHAIN

Every link hand welded

The chain you depend on in your work is "as strong as its weakest link." Because this is so literally true in dredging work, Woodhouse Chain is particularly interesting to operators because every link is hand welded. Practically, there is no weak link in a Woodhouse Chain.

Woodhouse Hand-made Chain is constructed of selected metal. The big advantage, however, is in the welding and shaping itself. It has added resistance against crystalization, and lastly, it has uniform strength throughout.

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Specifiy "Woodhouse Trenton" Chain

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WOODHOUSE CHAIN WORKS,
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Fig. 1076. **Flat Bottom, Open End Shelf Bucket:** for handling wet sticky substances which will not discharge readily from other styles of buckets.

Fig. 196. **Low Front:** for handling damp substances that will not discharge easily from the regular depth bucket.

Fig. 152. **Toothed Edge:** for handling materials which are liable to pack in the elevator boot or which, for other reasons, require the use of a digging edge.

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Successors to W. J. Clark Co.

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Easily raised, lowered and moved about, the Burch All Steel Portable Conveyor will load any kind of material at the rate of a yard per minute. One day you can work from stock pile and the next day direct from pit. Because of its portability it can easily be jumped from one loading job to another.

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BURCH PLOW WORKS CO.

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Whatever success Cyclone No. 14 Big Blast Hole Drills have attained in the quarry industry during the fifteen years of their existence has been due to close adherence to the following ideals and principles:

1—Starting with a design that was basically correct, originated after a close study of the requirements at the very beginning of the use of well drills in quarrying.

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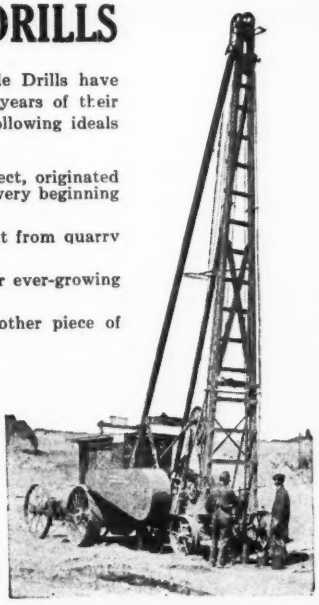

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WHATEVER your needs in mechanical handling and screening equipment for sand-and-gravel or quarry plant, you will profit by getting in touch with this Company. We carry an extensive stock and shop facilities for turning out your needed equipment in short order.

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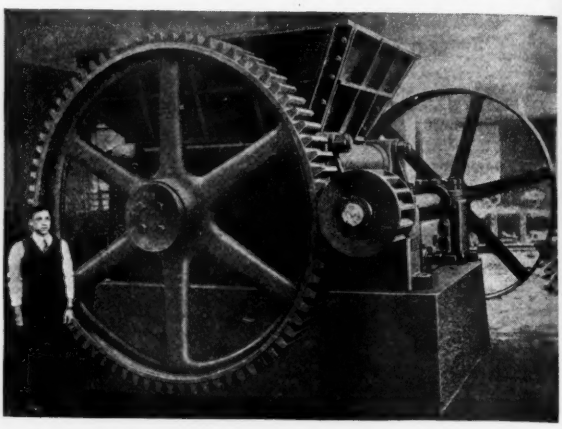
This is what you get from the McLanahan Single Roll Crusher. It is what operators of McLanahan Crushers have been getting for a third of a century past. It is compact, requires no apron or hand feeding, and handles wet or slimy as well as dry material.



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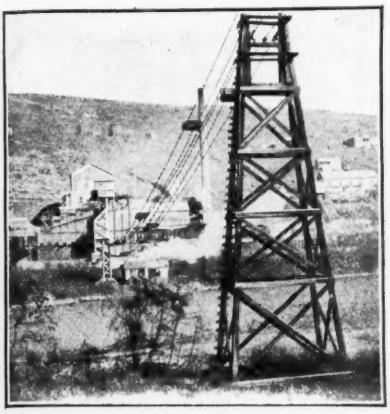

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No plant is more economical than its most costly operation. When this is Haulage the

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For all drilling and other quarry operations requiring pneumatic tools—use compressed air supplied by a Curtis Model "A". Fully enclosed Controlled Splash Oiling Compressor.

Curtis Model "A" Air Compressors are the result of over 28 years spent in the design and manufacture of air compressors known everywhere for their advanced engineering features, extreme durability and all-round mechanical excellence. They are full self-oiling through means of a controlled splash regulatable sight feed lubrication system.

Heads, valves and cylinder walls are water cooled and present a greater cooling surface than in double-acting compressors of equal capacity. This feature increases volumetric efficiency. Fully enclosed—dust and dirt proof. Built in various sizes and capacities up to 250 lb. displacement.

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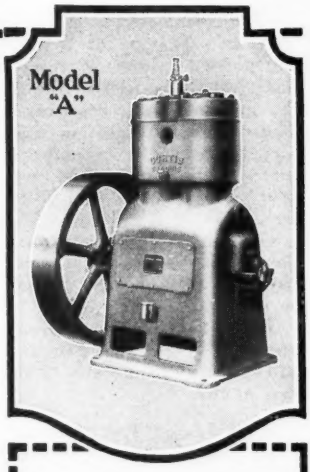

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Gentlemen: Please send full details on Curtis Air Compressors.

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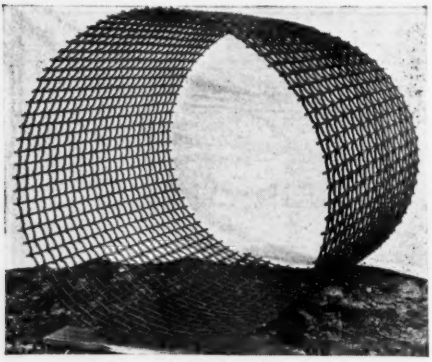

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DOUBLE LOCK MESH WOVEN SCREENS THAT LAST LONGER

Sliding, grinding and tearing through the mesh of a screen, sand, gravel and crushed stone wear out ordinary screens quickly.

ROL-MAN Double Lock Mesh Woven Manganese Steel Screens have two features that enable them to give many times the service of ordinary mesh or perforated plate screens. They are made of ROL-MAN Manganese Steel, the greatest wear resisting metal made. Their construction is such that the screening side presents a smooth, flat surface, making what wear there is evenly distributed, and gives larger production.

Diminished interruptions to operations ALONE more than pay the whole cost of ROL-MAN Manganese Steel Screens.

There are other features equally important. Our Screen Bulletin contains complete details. May we send you a copy?

Cross section view of lock mesh

MANGANESE STEEL FORGE CO.

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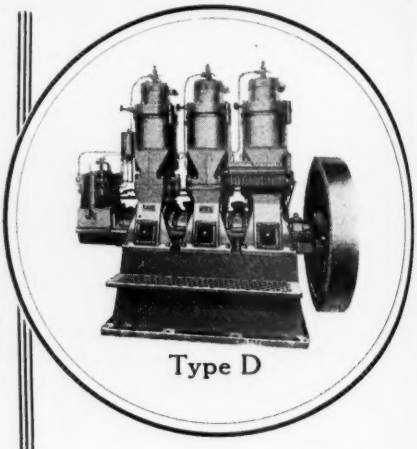

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Calls his Venn-Severin *"Old Faithful"*

WHEN the secretary of a sand and gravel company refers to their Venn-Severin Oil Engine as "Old Faithful," when the engineer of the same company says of the same engine, "It's the cat's whiskers," the service rendered by this Venn-Severin must have been unusual.

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There are fifteen features that make the Venn-Severin Type D Oil Engine a better engine. Our Type D Bulletin describes them fully. Write for a copy—then check against your present power costs.

Especially adapted to Dragline work.
Sizes range from 15 to 250 H. P.

VENN-SEVERIN MACHINE CO.

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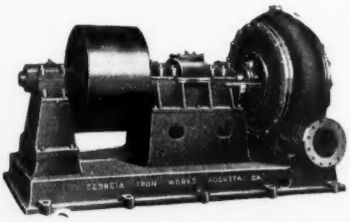
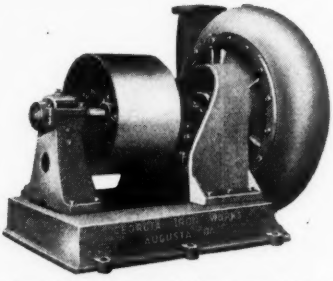


Heavy duty belt driven sand and dredging pump built in 8", 10", and 12" sizes.



Overhanging type belt driven sand dredging pump. Built in 6" and 8" sizes.

SAND PUMPS

The accompanying cuts show two very popular types of belt driven units. These pumps are also built with bases for direct connection to motor.

Send for illustrated catalog showing our complete line of this equipment including flanged pipe fittings and hydraulic guns.

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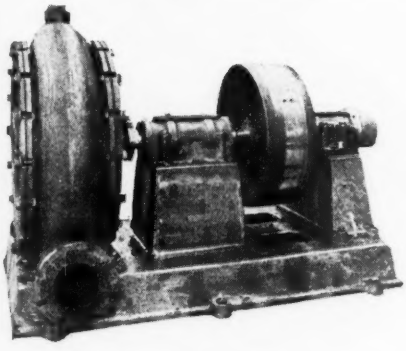

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Manganese Steel Sand and Gravel Pumps

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Built in all sizes.

Belt driven or direct connected motor driven.

Send pump inquiries to:

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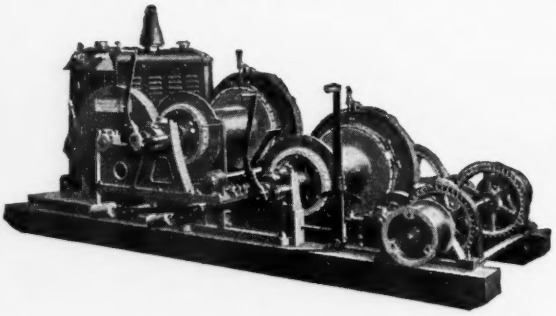

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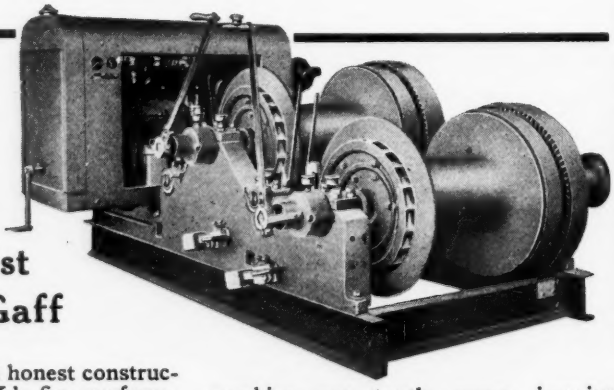

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The O K Hoist Stands the Gaff

Scientific design and honest construction produce the O. K.'s fine performance under hard conditions, and its durability. Because of its power and length of service, it costs less and does more work.

O. K. Hoists eliminate excess friction, resulting in substantial power saving. Every O. K. has generated machine—cut tooth gears, insuring accuracy, maximum strength and durability; driving pinion is solid machine steel; the cone drums are lined with asbestos friction instead of wood, or metal against metal.

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O. K. CLUTCH & MACHINERY CO.

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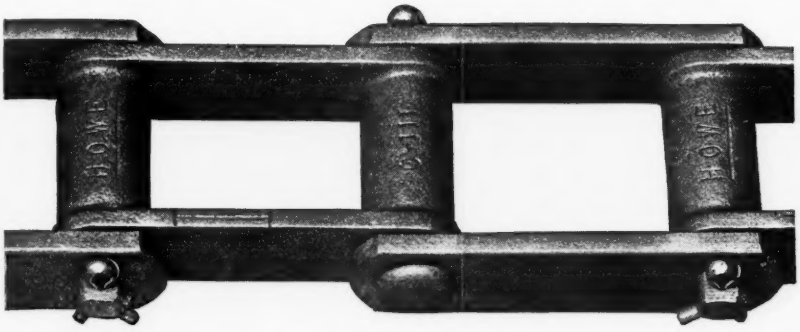

BECAUSE, as specialists, we have designed and built chains for practically every type of service, for conveying and power transmission purposes.

Our business has been built up entirely on the merit of our product and the prompt service we have given. We can supply your needs for standard chains, or manufacture chains to meet your special requirements.

The performance records of Howe Chains have maintained our reputation as builders of reliable chains, throughout industry.

For steel drive chains, conveyor chains, malleable iron chains, specify HOWE. Catalog, prices and full particulars on request.

H-1

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Closed End Pintle Chains.
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CHAIN SPECIALISTS

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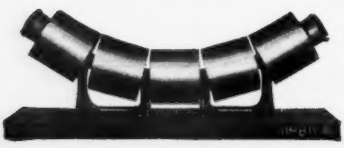
Belt Conveyors



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Power Transmission Machinery—Bearings, Pulleys, Gears, Chains and Wheels, Elevating and Conveying Machinery—Helicoid Conveyor, Chain Conveyors, Elevator Buckets, Boots, Casings, etc.

THE relatively light weight of the Caldwell Belt Conveyor, in proportion to capacity, makes it a desirable form to use where conveyor must be supported on trusses of considerable span.

This type of conveyor is also well suited, at shorter distances and slower speeds, for handling lime, cement, stone, etc., in bags; or in bulk.

Our experience and advice is at your disposal. Write or wire Caldwell, or the nearest Link-Belt Office.

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5 Yard Green Power Scraper—12x14 Steam Hoist

digging from under water and delivering to belt conveyor. The owner would not sell, but there are plenty more where this came from. Also smaller sizes. For further particulars, write

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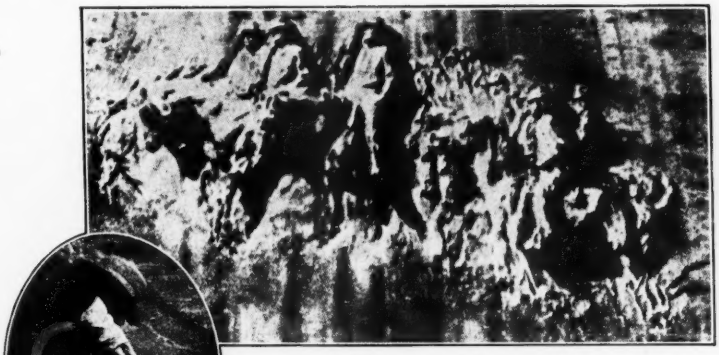

The monument that is being carved out of Stone Mountain, and a length of "U. S." 48-10 Air Hose at work on it.

The hose that is carving a mountain

The great Confederate memorial at Stone Mountain some day will extend its ranks for a quarter of a mile across the steep face of the cliffs. It has presented problems of execution which sculptor never before had to face.

The unaided hand of man could make no headway in carving a mountain into form, so pneumatic drills and chisels were called into play. The sinews of power are the lines of air hose stretching up hundreds of feet over the granite from the ground below.

And on this task for giants we find the giant among air hose—"U. S." 48-10.

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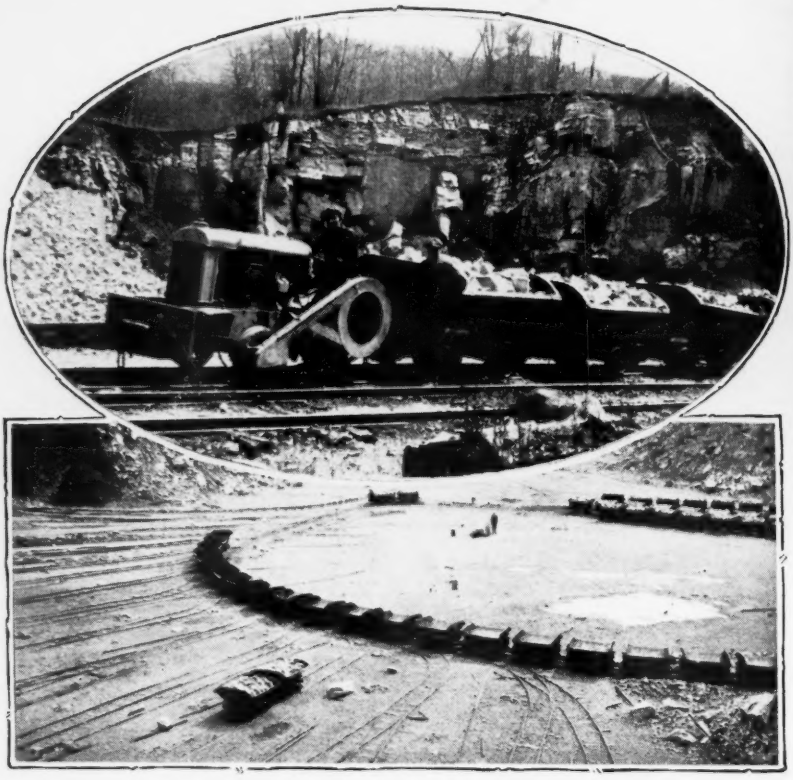
Branches in every industrial center



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This is an unusual situation, but it demonstrates the sturdiness and ability of the Brookville. For "short haul" power in the pit and quarry there is no comparable substitute for this long lived, sturdy, dependable gas locomotive with Fordson Tractor Power Unit.

You don't experiment with Brookvilles. Their proven dependability, as well as adaptability, has made them the choice of hundreds of successful operators.

Write today for details and prices.

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